



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

510-B-94-008

JAN 17 1995

OFFICE OF
SOLID WASTE AND EMERGENCY
RESPONSE

MEMORANDUM

TO: All Interested Parties

FROM: Lisa C. Lund, Acting Director *Lisa Lund*
Office of Underground Storage Tanks

RE: Leak Detection Equipment/Procedures Evaluations:
Draft List

Please find attached a draft list of underground storage tank (UST) system leak detection third-party evaluations. The attached draft list is being provided for your review prior to publication of the first edition. In general, the draft includes leak detection system evaluations performed by an independent third party in accordance with EPA standard test procedures (or equivalent procedures), with leak rates blind to the tester. This list was compiled based on reviews by a work group consisting of state and EPA regulators. This document is provided for review for accuracy and completeness and is not intended to be used for any other purpose. This draft list in no way implies that listed or unlisted leak detection equipment or procedures do or do not meet the criteria for which evaluations are reviewed.

The list is divided into three parts, a Summary section, a Specification section, and an Under Review section. The Summary section categorizes leak detection systems by the standard test procedures, or "protocol," used in the evaluations. The Specification section lists each system evaluation in alphabetical order by the name of the system vendor, and contains the system name, model number, and specifications, and also contains the name of the evaluator and date of the evaluation. The Under Review section lists systems about which the work group has received some information, and is either in the process of reviewing the third-party evaluation, or has requested additional information which is needed to clarify the evaluation. Listing of systems as "under review" in no way implies that the systems do or do not meet the criteria by which the evaluations are reviewed. The "under review" category will help vendors reviewing this draft list determine if the work group has received a copy of their third-party evaluation. Please note that multiple evaluations may exist for one system, and therefore there may be multiple listings for that system.



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For those who are not familiar with the work group, please refer to the attached August 4, 1994 memorandum from Curt Johnson, the work group's chair, providing background information.

Neither EPA nor the work group approve or will approve leak detection equipment or procedures. Approval or acceptance of leak detection equipment and procedures is the responsibility of the implementing agency, which in most cases is the state environmental agency. Please contact the implementing agency UST program manager to determine what systems are approved or acceptable for use in your area.

We plan to distribute the first edition of this list in the Summer of 1995. While the current draft list only includes a limited number of evaluations that followed non-EPA protocols, every effort will be made to review the majority of such evaluations for inclusion in the first edition list. The first edition also will be made available in electronic format on EPA's "CLU-IN" electronic bulletin board at no charge, and may be updated more frequently than the paper copy. We expect the list to be updated and paper copies distributed at approximately six month intervals, as new evaluations and information are reviewed.

EPA Region 10 has been publishing and updating a list of leak detection systems for several years, but has indicated that it will no longer update its list.

We believe that the first edition list can be of great benefit to the entire UST community. While it will be beneficial, please remember that it has inherent limitations. It will be based on evaluations, which are one-time events, often conducted in a lab setting. It therefore cannot determine that a particular system will work or comply with regulations at a particular site -- or at any site. For this and other reasons, any edition of this list is not intended to be -- and cannot be -- the final word; decision-makers must make up their own minds based on all available sources of information.

Your comments are important in making the first edition list as useful as possible. Please do not hesitate to provide feedback. All comments regarding this draft list should be made to the appropriate team leader for that type of evaluation. For new evaluations only, please send three copies to Harold Scott of EPA Region 10. When the first edition is published this summer, it will list a new contact, who will take over Mr. Scott's responsibilities as recipient and distributor of new evaluations. The team leaders' and Mr. Scott's addresses are found in the first attachment. In order to be considered for the first edition list, all comments and new evaluations should be submitted by March 1, 1995.

Attachments:

- * August 4, 1994, Johnson memo, with attachments
- * Disclaimer
- * Draft list

cc: State UST Program Managers

UST/LUST Regional Program Managers

David Lloyd, OGC

Recipients of EPA Region 10 Leak Detection Methods Document

Vendors appearing on Draft list

cc (cover only):

Frank Ciaviattieri, Region I

Stanley Siegel, Region II

Robert Greaves, Region III

Mary Kay Lynch, Region IV

Norman Niedergang, Region V

Guanita Reiter, Region VI

Lynn Harrington, Region VII

Robert Duprey, Region VIII

Laura Yoshii, Region IX

Ken Feigner, Region X

OUST Management Team

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ALABAMA
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

James W. Warr, Director

Jim Folsom
Governor

August 4, 1994

Mailing Address:
PO BOX 301463
MONTGOMERY AL
36130-1463

Physical Address:
1751 Cong. W. L.
Dickinson Drive
Montgomery, AL
36109-2608

(205) 271-7700
FAX 270-5612

MEMORANDUM

TO: Vendors of Leak Detection Equipment/Procedures
for Underground Storage Tanks

FROM: Curt D. Johnson *C.D.J.*
Chairperson

RE: Notice of Formation of Work Group for Review of
Underground Storage Tank Leak Detection Equipment/Procedures
Evaluations

Field Offices:

110 Vulcan Road
Birmingham, AL
35209-4702
(205) 942-6168
FAX 941-1603

400 Well Street
P.O. Box 953
Decatur, AL
35602-0953
(205) 353-1713
FAX 340-9359

2204 Perimeter Road
Mobile, AL
36615-1131
(205) 450-3400
FAX 479-2593

By now, most of you have heard of our work group, which was put together for the purpose of reviewing leak detection equipment/procedures evaluations. However, we have come to realize that you need to know more about the work group so you can better understand why we are requesting information concerning the evaluations you have performed on your leak detection equipment/procedures and what we intend to do with the information you send us.

Let me begin by providing some history behind the formation of the work group. Soon after leak detection equipment/procedures were required to be evaluated to prove its capability to meet EPA leak detection performance requirements, some states began to take a hard look at how the evaluations were performed instead of accepting the results at face value. The states reviewing these evaluations found most to be well done, but a few that were not properly tested in accordance with EPA Standard Test Procedures. Many other states expressed interest in these findings, but did not have the resources and/or expertise to review the evaluations themselves. At this point an effort was made to consolidate state and EPA expertise and resources in a work group for the purpose of reviewing leak detection equipment/procedures evaluations.

The resulting work group consists of 7 states, 2 EPA regions, and EPA's Office of Underground Storage Tanks (see attached member list). It is divided up into teams (see attached team list) which perform a detailed review of leak detection evaluation results, test data, calculations, test protocols, operating procedures, etc. in order to accomplish the following mission as established by the members of the work group.

The mission of the work group is to review release detection equipment/procedures evaluations to determine if each evaluation was performed in accordance with an acceptable protocol, to ensure that the equipment/procedures meet EPA performance standards.

EPA and member states will share the results of such reviews with interested parties.



As discussed in the "Forward" to all EPA Standard Test Procedures, both state agencies and tank owners prefer that evaluations be carried out by an independent third-party. In response to this, work group members agreed that it was appropriate to review only independent third-party evaluations performed in accordance with an acceptable protocol where leak rates are blind to the vendor.

If an EPA standard test procedure is not available for use to evaluate a certain type of equipment/procedure, the work group has agreed to review the test protocol. To avoid problems with evaluations performed using new protocols, the work group is offering to review them prior to the vendor proceeding with the third-party evaluation.

Prior to member states and EPA preparing a list or incorporating work group information into their existing equipment/procedures lists, a draft of the work group information pertaining to your leak detection equipment/procedures will be distributed by work group team leaders to allow for any necessary revisions to be made. In some cases, the information will include an "under review" category for equipment/procedures where the review could not be completed prior to the deadline.

It is expected that information gathered by the work group will be available for member states and EPA to establish or revise equipment/procedures lists prior to the end of FY 1994. Member states and EPA lists are expected to be finalized and made available to other states and any other interested parties shortly thereafter. It is anticipated that member states and EPA equipment/procedures lists may be used by others as follows:

1. by owners and operators in the selection of appropriate release detection equipment/procedures for their specific underground storage tank needs,
2. by vendors of release detection equipment/procedures for comparison with other vendor equipment/procedures as well as documents to be presented to other state, county and local regulatory agencies to gain acceptance in the respective jurisdiction,
3. by other state and local governments to the desired extent as a basis for determining whether or not the equipment meets their requirements, as a reference for comparison (for states who have their own review process or have more stringent requirements), or as a reference during field inspections to ensure that the leak detection equipment/procedures are being used properly in the field.

THE WORK GROUP DOES NOT HAVE THE AUTHORITY TO DETERMINE IF THE EQUIPMENT/PROCEDURES MEET STATE, OR LOCAL LEAK DETECTION REQUIREMENTS. Please contact the appropriate local authority to determine if your leak detection equipment/procedures meets their requirements.

Work group teams are currently being forwarded third-party evaluations and protocols through Region 10 EPA. If you have any existing or new evaluations that you want to send in to be reviewed, please send three copies of them to Harold Scott, USEPA Region 10. Mr. Scott's address is on the attached list of work group members. The information that is necessary to allow the work group to review an evaluation is included in the attached document list. The work group intends to meet approximately every 6 months to finalize the review of any new or existing evaluations and protocols received by Mr. Scott.

We believe the member states and EPA equipment/procedures lists will be beneficial to vendors as well as states, local government, and underground storage tanks owners and operators. However, we need your help and cooperation to make our effort a success. We strongly encourage you to work with us in this effort by contacting any of the work group members to discuss any questions or problems that may arise. A list of member phone numbers and addresses is attached.

CDJ/r1b

Enclosures - Member List
Team List
Leak Detection Equipment Review - Document List

LIST OF MEMBERS

Member	Address	Phone/Fax
Curt D. Johnson	Alabama Department of Environmental Management P.O. Box 301463 Montgomery, AL 36130-1463	(334) 271-7986 FAX (334) 270-5612
Mike Kadri	Michigan Department of Natural Resources UST Division P.O. Box 30157 Lansing, MI 48909-7657	(517) 335-7204 FAX (517) 335-2245
Beth DeHaas	Maine Department of Environmental Protection Statehouse Station No. 17 Augusta, ME 04333	(207) 287-2651 FAX (207) 287-7826
Russ Brauksieck	New York State Department of Environmental Conservation 50 Wolf Road, Room 340 Albany, NY 12233-3750	(518) 457-4351 FAX (518) 457-4332
David Wiley	U.S. EPA 401 M Street Southwest 5402W Washington, DC 20460	(703) 308-8877 FAX (703) 308-8505
Lamar Bradley	Tennessee Department of Environment & Conservation UST Division, 4th Floor L & C Tower 401 Church Street Nashville, TN 37243-1541	(615) 532-0952 532-0945 FAX (615) 532-0938
Randy Nelson	U.S. EPA Region 7 RCRA/STPG Branch 726 Minnesota Avenue Kansas City, KS 66101	(913) 551-7220 FAX (913) 551-7947
Thomas Springer	Oklahoma Corporation Commission Fuel Division P.O. Box 52000-2000 Oklahoma City, OK 73152-2000	(405) 521-3107 FAX (405) 521-6576
Ellen Van Duzee	U.S. EPA Idaho Operations 422 West Washington Street Boise, ID 83702	(208) 334-9507 FAX (208) 334-1231
Harold Scott	U.S. EPA Region 10 1200 Sixth Avenue Mailcode: WD133 Seattle, WA 98101	FAX (206) 553-0165
Shahla Farahnak	California State Water Resource Control Board Division of Clean Water Program P.O. Box 944212 Sacramento, CA 94244-2120	(916) 227-4350 FAX (916) 227-4349

members

Updated as of January 17, 1995.

Team List

Team	Leader	Members
Volumetric	DeHaas	Brauksieck
Non-Volumetric	Farahnak	Springer Brauksieck*
ATG	Van Duzee	Brauksieck
SIR	Bradley	DeHaas Kadri
Vapor/Liquid	Wiley	Van Duzee
Pipeline	Kadri	Farahnak Springer
Other	Nelson	Kadri Wiley Farahnak

* phasing out of this group

Updated as of January 17, 1995.

Leak Detection Equipment Review - Document List

This enclosure lists the documentation required for review of third-party evaluation of underground storage tank and line leak detection equipment or test methods.

1. A complete third-party evaluation report, including:
 - _____ a. *Details of the evaluation procedure if the EPA standard procedure was not used for the evaluation. If the EPA evaluation procedure was used, list any deviations or modifications to the procedure.*
 - _____ b. *Complete set of all the EPA required attachment sheets.*
 - _____ c. *Individual test logs and/or field notes.*
 - _____ d. *Statistical calculations and any applicable graphs or charts generated during the evaluation.*
 - _____ e. *A statement from the evaluator confirming that all equipment at the test site was properly maintained and calibrated to the level of accuracy necessary for a valid evaluation.*
- _____ 2. *An outline of the manufacturer's operating procedures for the equipment/method. The summary procedure must be dated and include a revision number, if applicable. A copy of the summary procedure must be provided to the third-party evaluator for enclosure in the report. Also required is a statement from the manufacturer confirming the use of the submitted procedure during the evaluation.*

- ___ 3. *Complete installation/operations manual for the equipment/method.*
- ___ 4. *A sample of the test report (including field work-sheets) which will be submitted to the owner/local implementing agency.*
- ___ 5. *Outline of the test procedures in high ground water areas. These procedures should be reviewed for adequacy by the third-party evaluator and a statement to that effect should be included with the report.*
- ___ 6. *Outline of the test procedures for manifolded tanks. These procedures should be reviewed for adequacy by the third-party evaluator and a statement to that effect should be included with the report.*
- ___ 7. *An affidavit from the manufacturer confirming that there are no mutual financial interests between the equipment manufacturer and the third-party evaluator.*
- ___ 8. *A resume, including all applicable formal training and experience, from personnel who conducted the evaluation.*
- ___ 9. *Equipment calibration procedures and manufacturer recommended schedule of calibration.*
- ___ 10. *The name, address, and phone number of the technical personnel serving as the manufacturer's representative for the response to the regulatory agency questions on the equipment or test method.*
- ___ 11. *Correspondence letters from state agencies who have reviewed the equipment/method.*

12. *Following documentation for all permanently-installed leak detection equipment:*

- _____ a. *A list of installers authorized by the manufacturer to install the leak detection equipment.*
- _____ b. *A list of service personnel authorized by the manufacturer to conduct the annual functional test (required for all leak detection equipment).*
- _____ c. *An outline of the maintenance procedure (including a list of the parts or functions of the system to be checked, calibrated, or programmed) for the annual functional test by authorized service personnel.*
- _____ d. *An outline (1 - 2 pages) "Equipment Check Guidelines for Inspectors" prepared by the manufacturer. This summary should guide local agency inspectors on proper field procedures to follow when inspecting equipment for proper operation, for attempting to access the stored history (for alarms or failed tests) to determine compliance with state requirements.*
- _____ e. *A sample of the reports generated and/or printed by the equipment (for all equipment models), and an explanation of the items in the report, if not self-explanatory.*
- _____ f. *Information on how the control panel modules connected to the various probes are labeled. The information on the panel should be directly comparable to the equipment name, model/part/probe number which will be included in the committee's list. If necessary, a permanent label containing that information should be affixed to the panel.*

13. *Following documentation for the methods using tracer analysis:*

- _____ a. *Name and certification of the laboratory analyzing vapor samples.*
- _____ b. *Quality Assurance Manual of the laboratory.*
- _____ c. *Method and amount of tracer injection.*
- _____ d. *Vapor sample collection method and chain of custody records.*
- _____ e. *Third party certification for capability of the test method to detect leaks from the ullage portion of the tank.*

DISCLAIMER

This draft list is being circulated for discussion purposes only, and its general release is not yet authorized. The purpose of the circulation is to allow representatives from state governments, leak detection system vendors, third-party evaluators, and EPA to review the document and provide comments thereon. THIS DOCUMENT MAY NOT BE USED OR RELIED UPON BY ANY PERSON OR ENTITY FOR ANY OTHER PURPOSE AS THE CONTENTS HEREIN ARE SUBJECT TO REVISION.

This draft list is limited to evaluations of leak detection equipment and procedures that the Work Group has completed review of, and that were conducted by an independent third-party evaluator with leak rates blind to the vendor. This draft list includes evaluations conducted in accordance with EPA Standard Test Procedures for Evaluating Leak Detection Methods (EPA/530/UST-90/00x) and as many evaluations conducted in accordance with other acceptable protocols as possible. The draft list includes an Under Review category of equipment/procedures evaluations, for which the Work Group review could not be finalized prior to publication.

THE LISTING OF EQUIPMENT/PROCEDURES EVALUATIONS AS "UNDER REVIEW" IN NO WAY IMPLIES THAT THE EQUIPMENT/PROCEDURES DO OR DO NOT MEET THE CRITERIA FOR WHICH EVALUATIONS ARE REVIEWED.

DRAFT

LIST OF LEAK DETECTION EVALUATIONS FOR UNDERGROUND STORAGE TANK (UST) SYSTEMS

January 17, 1995

[Attachment 3 to Jan. 17, 1995 memo]

SUMMARY SECTION

DRAFT

IN ORDER OF TYPE OF EVALUATION:

**VOLUMETRIC TANK TIGHTNESS TEST METHODS
NON-VOLUMETRIC TANK TIGHTNESS TEST METHODS
AUTOMATIC TANK GAUGING SYSTEMS
LIQUID PHASE OUT-OF-TANK PRODUCT DETECTORS
LIQUID PHASE INTERSTITIAL DETECTORS
VAPOR PHASE OUT-OF-TANK PRODUCT DETECTORS
DOUBLE WALLED TANK TIGHTNESS TESTS
LINE LEAK DETECTORS / LINE TIGHTNESS TEST METHODS
STATISTICAL INVENTORY RECONCILIATION (SIR) METHODS

AND ALPHABETICAL BY MODEL WITHIN EACH TYPE**

January 17, 1995

VOLUMETRIC TANK TIGHTNESS TEST METHODS

DRAFT

<u>Test Method</u>	<u>Evaluation Results</u>	<u>Manufacturer</u>
AES System II (Overfilled Test)	Threshold: 0.05 gph Overfilled Test Tanks to 15,000 gal 100% full tank	Associated Environmental Systems
AES System II (Overfilled Test-Large Tanks)	Threshold: 0.05 gph Overfilled Test Tanks to 75,000 gal 100% full tank	Associated Environmental Systems
Alert Model 1000	Threshold: 0.05 gph Underfilled Test Tanks to 30,000 gal 20-95% full tank	Alert Technologies
Automated Precision Tank Testing System (APTT System) R-2 Overfilled Test	Threshold: 0.05 gph Overfilled Test Tanks to 15,000 gal 100% full tank	Tank Automation
Computerized VPLT Underfilled Tank Tightness Testing System	Threshold: 0.05 gph Underfilled Test Tanks to 18,000 gal At least 24" of product	NDE Environmental
Horner Ezy-Chek I (manual)	Threshold: 0.05 gph Overfilled Test Tanks to 12,000 gal 100% full tank	Horner Creative Products
Horner Ezy-Chek II (computerized)	Threshold: 0.05 gph Overfilled Test Tanks to 12,000 gal 100% full tank	Horner Creative Products
Horner Ezy-Chek II	Threshold: 0.05 gph Underfilled Test Tanks to 12,000 gal 98-100% full tank	Horner Creative Products
Ibex Precision Test System	Threshold: 0.05 gph Overfilled Test Tanks to 18,000 gal 92% to 100% full tank	Ibex Industries
Leak Computer Tank Test System	Threshold: 0.05 gph Overfilled Test Tanks to 12,000 gal 100% full tank	Hasstech
Leak Computer Tank Test System	Threshold: 0.05 gph Underfilled Test Tanks to 15,000 gal At least 90% full tank	Hasstech

VOLUMETRIC TANK TIGHTNESS TEST METHODS

DRAFT

<u>Test Method</u>	<u>Evaluation Results</u>	<u>Manufacturer</u>
Petro Comp	Threshold: 0.05 gph Overfilled Test Tanks to 15,000 gal 100% full tank	Heath Consultants
Petro Tite II	Threshold: 0.05 gph Overfilled Test Tanks to 15,000 gal 100% full tank	Heath Consultants
Soiltest Ainlay Tank 'Tegrity Tester, S-3	Threshold: 0.05 gph Overfilled Test Tanks to 15,000 gal 100% full tank	Soiltest
Sure Test - Assured Tight System, Series IV	Threshold: 0.05 gph Underfilled Test Tanks to 18,000 gal 11-95% full tank	NDE Environmental
Tank Auditor, Version RTD V.2.16	Threshold: 0.05 gph Overfilled Test Tanks to 15,000 gal 100% full tank	Leak Detection Systems
Tel-A-Leak 1	Threshold: 0.05 gph Overfilled Test Tanks to 15,000 gal 100% full tank	Schuster Instruments
T.E.I. System 4000 Version 1.00	Threshold: 0.05 gph Underfilled Test Tanks to 15,000 gal 50-100% full tank	Triangle Environmental
UST 2000/P	Threshold: 0.05 gph Underfilled Test Tanks to 45,000 gal At least 78.6% full tank	USTest
UST 2000/LL	Threshold: 0.05 gph Underfilled Test Tanks to 15,000 gallons At least 15% full, & between 20 to 60 in. of product	USTest

NON-VOLUMETRIC TANK TIGHTNESS TEST METHODS

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Test Method	Evaluation Results	Manufacturer
Alert Ullage System - Model 1050 Ullage Test	Threshold: Ultrasonic signal relative to background levels. Up to 6,000 gal ullage	Alert Technologies
Alert Ullage System Model 1050 X Ullage Test	Threshold: Ultrasonic signal relative to background levels. Up to 24,000 gal ullage	Alert Technologies
EXY 3 (Underfilled Test)	Threshold: Pressure decay due to air ingress; Up to 12,000 gal tanks, w/ ullage volume 500-2500 gal	Horner Creative Products
TEI System 5000 Ver. 1.0	Threshold: Increase in the acoustical noise level; At least 14% full, Up to 20,000 gal	Triangle Environmental
TEI Ullage Test Ver. 1.0	Threshold: Increase in the acoustical noise level / water ingress; Up to 15,000 gal ullage	Triangle Environmental
Tracer Tight	Threshold: Detection of tracer chemical; Underfilled Test	Tracer Research
UST Ullage Test - Version ProEco U2	Threshold: Pressure Decay exceeding ± 0.016 psi/hr. Up to 10,260 gal ullage	NDE Environmental
UST 2000/U Ullage Test	Threshold: Noise level increase over background Up to 5250 gal for vacuum, up to 7550 gal for pressure	USTest
UTS-4T Ullage Test	Threshold: Make-up gas flow into ullage exceeding 0.275 cubic ft/hr. Up to 7,500 gal ullage	NDE Environmental
U3 Ullage Test (Vacuum or Pressure)	Threshold: Noise level increase over baseline Up to 16,500 gal ullage	NDE Environmental
VacuTect	Threshold: Air/Water ingress. Tanks to 75,000 gal At least 60% full tank	Tanknology
VacuTect Oil Tank System	Threshold: Air/Water ingress. Tanks to 1,500 gal At least 5% full tank	Tanknology

AUTOMATIC TANK GAUGING SYSTEMS

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Test Method	Evaluation Results	Manufacturer
Alert Model 2000 In-Tank Mass Measurement Probe System	0.2 gph Test: Threshold: 0.10 gph Tanks to 15,000 gal 50-95% full tank	Alert Technologies
Andover Controls Versions ACS+/AC256+ (Magnetostrictive Probe)	0.2 gph Test: Threshold: 0.1 gph Tanks to 15,000 gal 50-95% full tank	Andover Controls
Andover Infinity Version CX9000, CX9200, CX9240	0.1 gph Test: Threshold: 0.05 gph Tanks to 15,000 gal 50-95% full tank	Andover Controls
Auto Stik II, Auto Stik Jr.	0.2 gph Test: Threshold: 0.10 gph Tanks to 15,000 gal At least 50% full	EBW
E'SPI III	0.1 gph test: Threshold: 0.05 gph Tanks to 15,000 gal 50-95% full tank	Egemin Naamloze Vennootschap
E'SPI IV	0.2 gph Test: Threshold: 0.075 gph Tanks to 15,000 gal 50-95% full tank	Egemin Naamloze Vennootschap
EASI Level-Tru	0.2 gph Test: Threshold: 0.1 gph Tanks to 15,000 gal At least 50% full tank	Environment and Safety
EECO System Series	0.2 gph Precision & 0.2 gph Quick Test: Threshold: 0.10 gph At least 50% full tank Tanks to 15,000 gal	Emco Wheaton
	0.1 gph Precision & 0.1 gph Quick Test: Threshold: 0.05 gph 50-95% full tank Tanks to 15,000 gal	
EECO System TLM Monthly Quick Test	0.2 gph test: Threshold: 0.10 gph 50-95% full tank Tanks to 15,000 gal	Emco Wheaton

AUTOMATIC TANK GAUGING SYSTEMS

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Test Method	Evaluation Results	Manufacturer
EECO System TLM Monthly Test	0.2 gph test Threshold: 0.10 gph 50-95% full tank Tanks to 15,000 gal	Emco Wheaton
EECO System TLM Quick Precision	0.1 gph test Threshold: 0.05 gph 50-95% full tank Tanks to 15,000 gal	Emco Wheaton
EECO System TLM Quick Test	0.1 gph test Threshold: 0.05 gph 50-95% full tank Tanks to 15,000 gal	Emco Wheaton
Encompass MTS IPAM (Magnetostrictive Probe)	0.2 gph Test: Threshold: 0.1 gph At least 50% full tank Tanks to 15,000 gal	Arizona Instrument
Encompass USF IPAM (Ultrasonic Probe)	0.2 gph Test: Threshold: 0.1 gph At least 50% full tank Tanks to 15,000 gal	Arizona Instrument
Gasboy TMS 500	0.2 gph Test: Threshold: 0.10 gph Tanks to 15,000 gal 50-95% full tank	Gasboy International
Image II	0.2 gph Test: Threshold: 0.1 gph Tanks to 15,000 gal 90% full tank	Engineered Systems
Red Jacket ATM System, Ver. RLM 5000, 5001, 9000	0.2 gph Test: Threshold: 0.1 gph Tanks to 15,000 50-95% full tank	Marley Pump
Sonic Technology 1400-1800 Series Tank Monitoring System ATG Monitor/LLM Series /TMS Monitor	0.1 gph Test: Threshold: 0.05 gph Tanks to 18,000 gal 95% full tank 0.2 gph Test: Threshold: 0.1 gph Tanks to 18,000 gal 50-95% full tank	Marley Pump
TM 2, 3, 2.1, 3.1 Environmental Management Console PA0238000XXX Probe	0.2 gph Test: Threshold: 0.10 gph Tanks to 15,000 gal 50-95% full tank	Gilbarco Environmental Products

AUTOMATIC TANK GAUGING SYSTEMS

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Test Method	Evaluation Results	Manufacturer
TM 2.1, TM 3.1 Environmental Management Console Digital Sensing Probe PA0264XXX0000 Capacitance Probe	0.2 gph Test: Threshold: 0.126 gph 50-95% full tank 0.1 gph Test: Threshold: 0.071 gph At least 95% full tank Tanks to 15,000 gal	Gilbarco Environmental Products
TM 2.1, TM 3.1 Environmental Manage- ment Console Digital Sensing Probe PA0265XXX0000 Series Probe (Magnetostrictive)	0.2 gph Test: Threshold: 0.093 gph 50-95% full tank Tanks to 15,000 0.1 gph Test: Threshold: 0.069 gph At least 95% full tank Tanks to 15,000 gal	Gilbarco Environmental Products
TICS-1000	0.2 gph Test: Threshold: 0.1 gph ≥ 90% full tank Tanks to 15,000 gal	Universal Sensors & Devices
Tidel EMS Ver. EMS 2000, 3000, 3500; Probe #401-0009, #401-0010	0.2 gph Test: Threshold: 0.05 gph Tanks to 15,000 gal At least 15" product	Tidel Engineering
Tidel EMS 2000/3000/ 3500; Probe #401-0021, #401-0022	0.2 gph Test: Threshold: 0.1 gph At least 15" product	Tidel Engineering
TS 1000 Magnetostrictive Probe	0.2 gph Test: Threshold: 0.05 gph Tanks to 15,000 gal 50-95% full tank	Incon Environmental
TS 2000 Magnetostrictive Probe	0.2 gph Test: Threshold: 0.058 gph Tanks to 15,000 gal 50-95% full tank	Incon Environmental
Veeder-Root TIS-250/300/350 UST ATGS with 7842 Digital Sensing Capacitance Probe	0.2 gph Test: Threshold: 0.1 gph Tanks to 15,000 gal 50-95% full tank	Veeder-Root

AUTOMATIC TANK GAUGING SYSTEMS

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<u>Test Method</u>	<u>Evaluation Results</u>	<u>Manufacturer</u>
Veeder-Root TLS-250/2501/300/350 UST ATGS with 8472 Digital Sensing Capacitance Probe	0.2 gph Test: Threshold: 0.126 gph 50-95% full tank Tanks to 15,000 gal 0.1 gph Test: Threshold: 0.071 gph 50-95% full tank Tanks to 15,000 gal	Veeder-Root
Veeder-Root TLS-200/2001/250/2501/ 300/350/400 UST ATGS with 8473 Digital Sensing Probe (Magnetostrictive)	0.2 gph Test: Threshold: 0.093 gph 50-95% full tank Tanks to 15,000 gal 0.1 gph Test: Threshold: 0.069 gph 95% full tank Tanks to 15,000 gal	Veeder-Root
Veeder-Root 3000 Tank Level Module- TLP2; Normal/Rapid Test Mode (Formerly CEI 3000 TLP2)	0.2 gph Test: Threshold: 0.10 gph 50-95% full tank Tanks to 15,000 gal 0.1 gph Test: Threshold: 0.05 gph ≥ 95% full tank Tanks to 15,000 gal	Veeder-Root
X-76 ETM & X-76 ETM-4X	0.2 gph Test: Threshold: 0.1 gph 10-95% full tank Tanks to 15,000 gal 0.1 gph Test: Threshold: 0.05 gph 10-95% full tank Tanks to 15,000 gal	API/Ronan
7021 Digital Tank Gauge	0.2 gph Test: Threshold: 0.1 gph 10-95% full tank Tanks to 15,000 gal 0.1 gph Test: Threshold: 0.05 gph 10-95% full tank Tanks to 15,000 gal	Patriot Sensors & Controls

LIQUID PHASE OUT-OF-TANK PRODUCT DETECTORS

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<u>Test Method</u>	<u>Detector Principle</u>	<u>Manufacturer</u>
FCI Environmental Analog Hydrocarbon Probe ANP-100	Fiber optic chemical sensor	FCI Environmental
FCI Environmental Digital Hydrocarbon Probe DHP-100	Fiber optic chemical sensor	FCI Environmental
Gems Smartwell WPM-535 with Groundwater Probe WP-535	Conductive Polymer	IHO Industries
Gilbarco Environmental Management Console with Groundwater sensor, PA02700XX0001	Electrical Conductivity	Gilbarco Environmental Products
Leak Detection Systems KW-140 / KW-240 Monitors with Type 1 Sensor	Product Solubility	In-Situ
Leak Detection Systems KW-140 / KW-240 Monitors with Type 2 Sensor	Product Solubility	In-Situ
Leak Edge Models 100-3001, 100-4001	Product Permeability	One Plus
Leak Tracer Dye LTD Systems, Inc.	Product Solubility- Color Development	Advanced Tank Technology
LEAKWISE Groundwater Monitor, ID-220 Series Hydrocarbon on Water Detector	RF Attenuation	Agar
PermAlert PAL-AT Models AT20C, AT50C, AT40K; AGN Sensor Cable	Capacitance Change	PermAlert
PermAlert PAL-AT Models AT20C, AT50C, AT40K; PHFW Hydrocarbon Probe and Type 1 Sensor	Product Solubility	PermAlert
PermAlert PAL-AT Models AT20C, AT50C, AT40K; PHFW Hydrocarbon Probe and Type 2 Sensor	Product Solubility	PermAlert

LIQUID PHASE OUT-OF-TANK PRODUCT DETECTORS

<u>Test Method</u>	<u>Detector Principle</u>	<u>Manufacturer</u>
PermAlert PAL-AT Models AT20C, AT50C, AT40K: TFE Hydrocarbon Sensor Cable	Capacitance Change	PermAlert
Pollulert Probes MD221G/T, MD221G/TRA	Electrical Conductivity	Mallory Controls
Pollulert Probes MD241K, MD241RRA, MD241G, MD241GRA	Electrical Conductivity	Mallory Controls
Petro Vend SiteSentinel: 30-3206, -3207, -3210 Sensors	Product Permeability	Petro Vend
TraceTek Alarm and Locator Modules TT502 Fuel Sensing Cable	Electrical Conductivity	Raychem
Tidel EMS-3500 with Monitoring Well Probes Part 301-0641	Conductivity via Resistor Ladder Network	Tidel Engineering
Tidel EMS-3500 with Sheen Probes Probes Part 301-0687	Electrical Conductivity/ Hydrocarbon Sensitive Polymer	Tidel Engineering
Tidel EMS-3500 Detector 301-0762	Electrical Conductivity/ Hydrocarbon Sensitive Polymer	Tidel Engineering
Tidel Detectors 301-0324-001, 301-0325-001	Electrical Conductivity	Tidel Engineering
Tidel Detectors 301-0326-001, 301-0326-002	Electrical Conductivity	Tidel Engineering
Veeder-Root ILS-350, TLS-350, TLS-350R: Groundwater Sensor (794380-621, -622, -624)	Electrical Conductivity	Veeder-Root

LIQUID PHASE INTERSTITIAL DETECTORS

<u>Test Method</u>	<u>Detector Principle</u>	<u>Manufacturer</u>
Arizona Instrument Soil Sentry Liquid 330, 17-330-A/17-330-B, Probes 17-141A, 17-142A, 17-143A, 17-144A	Refraction	Arizona Instrument
Arizona Instrument TLM-830 Probes 17-141A, 17-142A, 17-143A 17-144A	Refraction	Arizona Instrument
Gilbarco PA02590XX000	Float Switch	Gilbarco Environmental Products
Gilbarco PA02591144000	Float Switch	Gilbarco Environmental Products
Gilbarco PA02592000000	Float Switch	Gilbarco Environmental Products
LDE 700, LDE 740, LDE 9000: Sensor Probe Models 9-901, 9-902, and 9-903	Capacitance	Pneumercator Company
PermAlert PAL-AT Models AT20C, AT50C, AT40K: PHL Hydrocarbon Sensor	Electrical Conductivity	PermAlert
PermAlert TankWatch PEM10, PEMS: Combination Hydrocarbon/Water Probe	Electrical Conductivity	PermAlert
PermAlert TankWatch PEM10, PEMS: Hydrocarbon Probe	Electrical Conductivity	PermAlert
Petro Vend Petrosentry IV, Petrosentry VIII, SiteSentinel: Liquid Sensor	Thermal Conductivity	Petro Vend
Petro Vend Petrosentry IV, Petrosentry VIII, SiteSentinel: Universal Reservoir Sensor	Float Switch	Petro Vend

LIQUID PHASE INTERSTITIAL DETECTORS

<u>Test Method</u>	<u>Detector Principle</u>	<u>Manufacturer</u>
Petro Vend Petroentry IV, Petroentry VIII, SiteSentinel, Universal Sump Sensor	Float Switch	Petro Vend
Tidel EMS-3500 Containment Sump Probes Part 301-0642	Magnetic Switch / Float and Hydrocarbon Sensitive Polymer	Tidel Engineering
Tidel EMS-3500 Liquid Discriminatory Probes 301-0635	Electrical Conductivity / Hydrocarbon Sensitive Polymer	Tidel Engineering
Tidel EMS-3500 Detector 301-0752-001	Float Switch	Tidel Engineering
Universal Leak Alert System Models LAL-100, LA-01, LA-02, LA-04, LA-X4, LA-08, CATLAS: Liquid Sensor LALS-1	Thermal Conductivity	Universal Sensors and Devices
Veeder-Root TLS-350 Discriminating Interstitial Liquid Sensor	Capacitance Change/ Ultrasonic	Veeder-Root
Veeder-Root TLS-350 Dispenser Pan Sensors, Containment Sump Sensors	Electrical Conductivity/ Ultrasonic	Veeder-Root
Veeder-Root TLS-350 Dual and Single Stage Hydrostatic Sensors	Float Switch	Veeder-Root
Veeder-Root TLS-250i, TLS 250i Plus, ILS 250, ILS 350, TLS-350 Interstitial Liquid Sensor for Fiberglass Tanks (0794390-401)	Float Switch	Veeder-Root
Veeder-Root TLS-250, TLS 250i Plus, ILS 250, ILS 350, TLS-350 Interstitial Liquid Sensor for Steel Tanks (0794390-420)	Float Switch	Veeder-Root

LIQUID PHASE INTERSTITIAL DETECTORS

<u>Test Method</u>	<u>Detector Principle</u>	<u>Manufacturer</u>
Veeder-Root TLS-250i, TLS 250i Plus, ILS 250, ILS 350, TLS-350 Liquid Sensor for Sumps (0794390-206)	Float Switch	Veeder-Root
Veeder-Root TLS-350: Solid-State Pan/Sump Sensor (794380-321, -351), Piping Sump Sensor (794380-208), Micro Sensor (794380-340)	Product Permeability/ Ultrasonic/ Float Switch	Veeder-Root

VAPOR PHASE OUT-OF-TANK PRODUCT DETECTORS

Test Method	Detector Principle	Manufacturer
Arizona Instrument Soil Sentry Twelve-X	Metal Oxide Semiconductor	Arizona Instrument
FCI Environmental Analog Hydrocarbon Probe AHP-100	Fiber optic chemical sensor	FCI Environmental
FCI Environmental Digital Hydrocarbon Probe DHP-100	Fiber optic chemical sensor	FCI Environmental
Fuel Finder Version IV	Adsorption Sampling	Environmental Fuel Systems
Gilbarco PA02660000000	Adsistor	Gilbarco Environmental Products
MSA Tankgard	Metal Oxide Semiconductor	Mine Safety Appliances
MSA Tankgard VIII	Metal Oxide Semiconductor	Mine Safety Appliances
Petro Vend Petroentry TLD III	Metal Oxide Semiconductor	Petro Vend
Petro Vend SiteSentinel Smart Module and Vapor Sensor	Metal Oxide Semiconductor	Petro Vend
Pollulert Probes MD221V, MD221VRA, MD210V, MD210VRA	Adsistor	Mallory Controls
Tidel EMS-3000 301-0328-001, 301-0330-001	Adsistor	Tidel Engineering
Tidel EMS-3500 301-0634	Adsistor	Tidel Engineering
Universal Leak Alert System Models LAL-100, LA-01, LA-02, LA-04, LA-X4, LA-08, CATLAS: LAVS-1 MOS Vapor Sensor	Metal Oxide Semiconductor	Universal Sensors and Devices
Veeder-Root ILS 350, TLS-350 Adsistor Vapor Probes	Adsistor	Veeder-Root
Warrick Model 5700 Meter PVP-2 Sensor	Adsistor	Warrick Controls

DOUBLE WALLED TANK TIGHTNESS TEST

Test Method	Evaluation Results	Manufacturer
O/C Tanks Hydrostatic Precision Tank Test for DWT-Type II Tanks	Threshold: 0.05 gph without dispensing 0.07 gph w/dispersing Tanks to 13,000 gallons 0-100% Full Tank	O/C Tanks
Xerxes Truchek Hydrostatic Monitoring System	Threshold: 0.05 gph Tanks to 30,000 gph 0-100% full	Xerxes

LINE LEAK DETECTORS / LINE TIGHTNESS TEST METHODS

<u>Test Method</u>	<u>Evaluation Results</u>	<u>Manufacturer</u>
AcuRite	Line Tightness Test Threshold: 0.01 gph	Hasstech
EXCO System ILD	Automatic Electronic Line Leak Detector Threshold: 2.0 gph (3 gph test) 0.1293 gph (0.2 gph test) 0.0793 gph (0.1 gph test)	Emco Wheaton
Environmental Management Console with Line Leak Detector PA02630000501	Electronic Line Leak Detector Threshold: 1.5 gph (3 gph test) 0.079 gph (0.1 gph test) 0.1 gph (0.2 gph test)	Gilbarco Environmental Products
Horner EHY-Chek Manual Line Leak Detector	Line Tightness Test Threshold: 0.05	Horner Creative Products
Horner EHY-Chek II Automatic Line Leak Detector	Line Tightness Test Threshold: 0.05	Horner Creative Products
LineTite Pipeline Leak Monitor	Automatic Electronic Line Leak Detector Threshold: 2.00 gph (3.0 gph test) 0.062 gph (0.1 gph test)	Hasstech
LLP1	Automatic Electronic Line Leak Detector Threshold: 1.88 gph (3 gph test)	Control Engineers
LLP2	Automatic Electronic Line Leak Detector Threshold: 1.88 gph (3 gph test) 0.05 gph (0.1 gph test)	Control Engineers
LS300, LS300 M/C, LS300-120, LS300-120 XLC, LS300-120 PLUS, LS300-120 PLUS A/S	Automatic Electronic Line Leak Detector; Threshold: 2.36 gph (3 gph test)	Campo/Miller
Petro Tite Line Tester	Line Tightness Test Threshold: 0.01 gph	Heath Consultants
PLT-100R	Line Tightness Test Threshold: 0.05 gph	Associated Environmental Systems
Proline Test Series III, Ver. 1.0	Line Tightness Test Threshold: 0.05 gph	NDE Environmental

LINE LEAK DETECTORS / LINE TIGHTNESS TEST METHODS

<u>Test Method</u>	<u>Evaluation Results</u>	<u>Manufacturer</u>
PTX-88	Line Tightness Test Threshold: 0.05 gph	NDE Environmental
Red Jacket PPM 4000, RLM 9000, RLM 10000, ST 1401, ST 1401L, ST 1801, ST 1801L	Automatic Electronic Line Leak Detector Threshold: 3 gph test (3 gph test) 0.047 gph test (0.1 gph test)	Harley Pump
Red Jacket DLD and XLD	Mechanical Line Leak Detector Threshold: 2.0 gph (3 gph test)	Harley Pump
Red Jacket FX1/FX2	Mechanical Line Leak Detector Threshold: 2.0 gph (3 gph test)	Harley Pump
Red Jacket FX1/FX2 Flexline	Mechanical Line Leak Detector Threshold: 2.0 gph (3 gph test)	Harley Pump
Red Jacket FX1/FX2-D (Bigflow)	Mechanical Line Leak Detector Threshold: 2.0 gph (3 gph test)	Harley Pump
Red Jacket XLP	Mechanical Line Leak Detector (rigid and flex line) Threshold: 2.0 gph (3 gph test)	Harley Pump
Ronan X-76 Automatic Line Leak Detector	Automatic Electronic Line Leak Detector Threshold: 0.831 gph (3 gph test) 0.066 gph (0.1 gph test)	API/Ronan
STP-MLD Pipeline Leak Detector	Mechanical Line Leak Detector Threshold: 2.0 gph	FE Petro
STP-MLD-D Pipeline Leak Detector (Diesel)	Mechanical Hourly Line Leak Detector Threshold: 2.0 gph	FE Petro
STP-MLD-E Line (Flexline) Leak Detector	Mechanical Hourly Line Leak Detector Threshold: 2.0 gph	FE Petro
T.E.I. Model LT-3, Ver. 1.0	Line Tightness Test Threshold: 0.05 gph (0.1 gph test)	Triangle Environmental

LINE LEAK DETECTORS / LINE TIGHTNESS TEST METHODS

<u>Test Method</u>	<u>Evaluation Results</u>	<u>Manufacturer</u>
TLD-1	Line Tightness Test Threshold: 0.05 gph (0.1 gph test)	Tanknology
Tokheim Pressure Monitor, Models PM 101 and 585A-PM	Mechanical Line Leak Detector Threshold: 2.25 gph	Tokheim
Tracer Tight Line Test	Line Tightness Test Threshold: Detection of tracer chemical	Tracer Research
Vaporless LD 2000	Mechanical Line Leak Detector Threshold: 1.7 gph (3 gph test)	Vaporless Manufacturing
Vaporless LD 2000E	Mechanical Line Leak Detector Threshold: 2.0 gph (3 gph test)	Vaporless Manufacturing
Vaporless LD 2000T	Mechanical Line Leak Detector Threshold: 2.5 gph (3 gph test)	Vaporless Manufacturing
Vaporless LD 3000 & LD 3000S	Mechanical Line Leak Detector Threshold: 2.0 gph (3 gph test)	Vaporless Manufacturing
Veeder-Root TLS Line Leak Detection Series 8475	Automatic Electronic Line Leak Detector Threshold: 1.5 gph (3 gph test) 0.1 gph (0.2 gph test) 0.079 gph (0.1 gph test)	Veeder-Root
Veeder-Root TLS Line Leak Detection Series 8484	Automatic Electronic Line Leak Detector Threshold: 1.88 gph (3 gph test) 0.05 gph (0.1 gph test)	Veeder-Root

STATISTICAL INVENTORY RECONCILIATION (SIR) METHODS

<u>Test Method</u>	<u>Evaluation Results</u>	<u>Vendor</u>
Enviro Tite SIR (a.k.a. SIRAS 99.6)	Threshold: 0.05 gph quantitative method Tanks to 18,000 gal	EnviroQuest Technologies
Mitchell's SIR Program V.2.6 12-13-91	Threshold: 0.05 gph quantitative method Tanks to 18,000 gal	S.I.R. International
Precision Tank Inventory Control System, Rev. 90 (Quantitative)	Threshold: 0.05 gph quantitative Method Single Tank to 21,000 gal Manifolded systems to 60,000 gal	Entropy
Precision Tank Inventory Control System, Version 90 (Qualitative)	Threshold: 0.04 gph qualitative method Tanks to 30,000 gal	Entropy
SIR 5.7	Threshold: 0.05 gph quantitative method Tanks to 18,000 gal	Simmons Sirvey Group
SIR MONITOR	Threshold: 0.05 gph quantitative method Tanks to 18,000 gal	Sir Phoenix
SIR PRO 1 Version 1.0	Threshold: 0.1 gph qualitative method Tanks to 18,000 gal	Horner Creative Products
SIR PRO 1 Version 2.0	Threshold: 0.05 gph qualitative method Tanks to 18,000 gal	Horner Creative Products
SIRAS Software System Version 2.0	Threshold: 0.05 gph Quantitative Method Tanks to 30,000 gal	EnviroQuest Technologies
SIRAS Software System Version 2.8.3	Threshold: 0.10 gph Quantitative Method Tanks to 30,000 gallons	EnviroQuest Technologies
SIRTECH	Threshold: 0.05gph quantitative method Tanks to 18,000 gal	Environmental Management Technologies
Store Vision Version E.2	Threshold: 0.0834 gph Qualitative Method Tanks to 12,000 gallons	Syscorp
USTMAN SIR 1.91	Threshold: 0.1 gph quantitative method Tanks to 18,000 gal	USTMAN Industries

USTHUM SIR
Version: 96.1

Threshold: 0.05 gph
quantitative method
Tanks to 30,000 gal

USTHUM TKS SIR 90

Threshold: 0.1 gph
qualitative method
Tanks to 15,000 gal

HRA Statistical
Inventory Analysis
Version 5.1

Threshold: 0.05 gph
quantitative method
Tanks to 18,000 gal

USTHUM

USTHUM Industries

USTHUM Industries

Warren Rogers Associates

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SPECIFICATION SECTION

**ALPHABETICAL BY COMPANY,
THEN BY TYPE OF EVALUATION,
THEN BY MODEL,
THEN BY LEAK RATE: 3, 0.2, 0.1 GPH**

January 17, 1995

Advanced Tank Technology, Inc.

Leak Tracer Dye (LTD)
LTD Systems, Inc.

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
 Sampling frequency: continuous
 Operating principle: Product solubility - color development

Test Results:

	Commercial Gasoline	Synthetic Gasoline
Accuracy(%)	100 (above 8 ppm)	100 (above 23 ppm)
Detection time(min:sec)	<00:01	<00:01
Fall Time (min:sec)	Not App.	Not App.
Lower detection limit(cm)	<0.32	<0.32

Specificity Results:

Activated: commercial gasoline, n-Hexane, diesel fuel, Jet-A fuel, toluene, JP-4 jet fuel, synthetic gasoline, xylene(s).

Manufacturer's Specifications:

LTD develops color in alcohols, ketones, solvents, and PCBs as well as petroleum products.

Comments:

EPA and many states require detection of 1/8 inch of product, which is 0.32 cm. The detector is not reusable, and must be replaced after contact with hydrocarbons.

Advanced Tank Technology, Inc.
 820 N. Sylvania
 Fort Worth, TX 76111
 Tel: (817) 831-3246

Evaluator: Glenn B. White, Scientific Information Services

Date of evaluation: 02-02-93

Agar Corporation

LEAKWISE Groundwater Monitor
ID-220 Series Hydrocarbon on Water Detector System

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
 Sampling frequency: continuous
 Operating principle: radio frequency (RF) attenuation

Test Results:

	Commercial Gasoline	Synthetic Gasoline
Accuracy(%)	100	100
Detection time(min:sec)	<00:01	<00:01
Fall Time (min:sec)	<00:01	<00:01
Lower detection limit(cm)		
* "Standard" setting	0.16	0.32
* "Sensitive" setting	0.03	0.03

Specificity Results:

Activated: commercial gasoline, n-Hexane, diesel fuel, Jet-A fuel, toluene, synthetic gasoline, xylene(s), water.

Manufacturer's Specifications:

Operating range:

Resolution: 0.5 mm of hydrocarbon on water or brine.
 Variation: water table fluctuation of +/- 1 meter standard (larger variations optional).
 Oil thickness: 0.3 - 25 mm optional (higher ranges available).
 Temperature: 0° - 70° C (higher available).

Comments:

EPA and many states require detection of 1/8 inch of product, which is 0.32 cm. This detector is reusable. Color coded signal lights indicate the presence of air, water, and hydrocarbon liquid when activated (yellow, green, and red, respectively).

Agar Corporation
 P.O. Box 802127
 Houston, TX 77280-2127
 Tel: (713) 464-4451

Evaluator: Ken Wilcox Associates, Inc.

Date of evaluation: 11-15-91

VOLUMETRIC TANK TIGHTNESS TEST METHOD

Certification:	Leak rate of 0.1 gallon per hour with $P_D=98.2\%$ & $P_{FA}=1.8\%$ for 2 hr test and $P_D=99.8\%$ & $P_{FA}=0.2\%$ for 4 hr test.
Leak Threshold:	0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
Applicability:	Gasoline, diesel, aviation fuel, fuel oil #4, fuel oil #6, solvent, waste oil and other compatible products.
Capacity:	The maximum tank capacity is 30,000 gallons. This equipment is capable of testing a tank at product levels from 20 to 95% full.
Waiting time:	Minimum waiting time between delivery and the beginning of the test data collection must be at least 1 hour. There must be no product delivery during the test waiting time.
Test Period:	The minimum data collection time must be 4 hours to achieve P_D of 99.8% and P_{FA} of 0.2% and 2 hours to achieve P_D of 98.2% and P_{FA} of 1.8%. The test data must be acquired and recorded by a computer. Leak rate is calculated from the data determined to be valid by statistical analysis. There must be no dispensing or product delivery during the test.
Ground Water:	Depth to the water table present in the backfill must be determined, and if it is above the bottom of the tank, product level must be adjusted to provide minimum of 2 psi net pressure on the bottom of the tank.
Calibration:	The load cell must be calibrated before each test.
Comments:	This system was not evaluated using manifolded tanks. This system tests only the portion of the tank containing product. As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).

Alert Technologies, Inc.
3350 W. Salt Creek Lane, Suite 109
Arlington, IL 60005
Tel: (800) 322-7845

Evaluator: Ken Wilcox Associates

Date of Evaluation: 04-26-91

NON-VOLUMETRIC ULLAGE TANK TIGHTNESS TEST METHOD

Certification:	Leak rate of 0.1 gallon per hour with $P_D=100\%$ & $P_{FA}=0\%$.
Leak Threshold:	Ultrasonic signal when the tank is under pressure or vacuum is compared to background signal (prior to pressurization). A leak is declared if the ratio exceeds 1.5 for either 12 kHz or 25 kHz frequency band.
Applicability:	Gasoline, diesel, aviation fuel, heavy fuel oils (#2 through #6), solvents, and waste oil.
Capacity:	The maximum ullage volume is 6,000 gallons.
Waiting time:	There is no waiting time after product delivery if the test is conducted after an underfilled tank tightness test.
Test Period:	The minimum data collection time is 5 minutes. The test data is to be acquired and recorded by a computer.
Test Pressure:	A net pressure of 1.5 psi (or -1.0 psi) in the ullage portion of the tank is maintained. Tank system must be able to maintain pressure or vacuum with a loss of less than 0.4 psig.
Ground Water:	Depth to water table must be determined. If water table is present outside the ullage portion of the tank vacuum-ullage test must not be used; Pressure-ullage test must be done under a net outward pressure of 1.5 psi.
Calibration:	Equipment is calibrated before each test.
Comments:	This test method only tests the ullage portion of the tank, the product-filled portion of the tank must be tested with an underfilled test method. Vibration due to nearby equipment and dripping condensation can interfere with this test method. When testing with vacuum, this test method may not be effective in some backfill because some backfill (such as clay) may plug a hole in the tank. Manifolded tanks are isolated prior to the test. During the third-party evaluation unleaded gasoline was used. During the third-party evaluation microphone was located 25 feet away from the leak simulator.

Alert Technologies, Inc.
3350 W. Salt Creek Lane, Suite 109
Arlington Heights, IL 60005
Tel: (800) 322-7845

Evaluator: Ken Wilcox Associates

Date of Evaluation: 03-15-92

NON-VOLUMETRIC ULLAGE TANK TIGHTNESS TEST METHOD

- Certification:** Leak rate of 0.1 gallon per hour with $P_0 = 100\%$ & $P_{FA} = 0\%$.
- Leak Threshold:** Ultrasonic signal when the tank is under vacuum is compared to background signal (prior to vacuum). A leak is declared if the ratio exceeds 1.5 for either 12 kHz or 25 kHz frequency band.
- Applicability:** Gasoline, diesel, aviation fuel, heavy fuel oils (#2 through #6), solvents, and waste oil.
- Capacity:** The maximum ullage volume is 24,000 gallons.
- Waiting time:** There is no waiting time after product delivery if the test is conducted after an underfilled tank tightness test.
- Test Period:** The data collection time is 5 minutes.
The test data is acquired and recorded by a computer.
- Test Pressure:** A net pressure of 1.5 psi (or -1.0 psi) in the ullage portion of the tank is maintained. Tank system must be able to maintain pressure or vacuum with a loss of less than 0.4 psig.
Zero pressure (background) must produce a flat line response.
- Ground Water:** Depth to water table must be determined. If water table is present outside the ullage portion of the tank vacuum-ullage test must not be used; Pressure-ullage test must be done under a net outward pressure of 1.5 psi.
- Calibration:** Equipment is calibrated before each test.
- Comments:**
- This test method only tests the ullage portion of the tank, the product-filled portion of the tank must be tested with an underfilled test method.
 - Vibration due to nearby equipment and dripping condensation can interfere with this test method.
 - When testing with vacuum, this test method may not be effective in some backfill because some backfill (such as clay) may plug a hole in the tank.
 - Manifolder tanks are isolated prior to the test.
 - During the third-party evaluation #4 fuel oil was used.
 - During the third-party evaluation microphone was located 25 feet away from the leak simulator.

AUTOMATIC TANK GAUGING SYSTEM*

- Certification:** Leak rate of 0.2 gallon per hour with $P_0 = 95.4\%$ & $P_{FA} = 4.6\%$ (calculated based on a one-hour test).
- Leak Threshold:** 0.10 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil, waste oil, and solvents.
- Capacity:** The maximum tank capacity must be 15,000 gallons.
The tank must be between 50 and 95% full.
- Waiting Time:** Minimum waiting time between product delivery to the tank and test data collection must be 15 hours.
- Test Period:** The minimum data collection time must be 2 hours.
Test data must be acquired and recorded by computer.
Leak rate is calculated from data determined to be valid by statistical analysis.
There must be no dispensing or product delivery during the test.
- Water Sensor:** A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 0.175 inches (0.27 inches for waste oil).
Minimum change in water level that can be detected is 0.088 inches (0.031 inches for waste oil).
- Calibration:** Mass measurement probe and water sensor must be checked and calibrated annually.
- * This is a battery operated system and does not automatically generate a hard copy of the leak test result. However, a hard copy of the results can be obtained by transfer of data to another unit (see manufacturer's instructions for further details). This system is not equipped with any alarms (e.g. high water alarm, or failed leak test alarm).
- Comments:** This equipment was not evaluated using manifolded tanks.
This equipment only tests the portion of the tank that contains product.
As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).
2000-X model which was certified for use on tanks up to 30,000 gal capacity and 2000-XB model which was certified for use on tanks up to 72,948 gallons are still under review.

DRAFT

Andover Controls Corporation

Andover Infinity
CX9000, CX9200, and CMX240

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.1 gallon per hour with $P_D=97.6\%$ & $P_{FA}=2.4\%$.

Leak Threshold: 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4, fuel oil #6, solvents, and other compatible products with known coefficients of expansion and density.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be between 50 and 95% full.

Waiting Time: Minimum waiting time between delivery to the tank and test data collection must be 6 hours.

Test Period: The minimum data collection time must be 6 hours.
Test data is acquired and recorded by a computer.
Leak rate is calculated as the average of subsets of all data collected.
There must be no dispensing or product delivery during the test.

Temperature: A minimum of 3 Resistance Temperature Detectors must be used to determine the average temperature of the stored product.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 0.35 inches.
Minimum detectable change in water level is 0.003 inches.

Calibration: Temperature sensors and probe must be checked and calibrated in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment only tests the portion of the tank that contains product.
As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).

Andover Controls Corporation
300 Brickstone Square
Andover, MA 01810
Tel: (508) 470-0555

Evaluator: Ken Wilcox Associates

Date of Evaluation: 5-24-93

DRAFT

Andover Controls

versions AC8+/AC255+
(Magnetostrictive Probe)

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.2 gallon per hour with $P_D=99.5\%$ & $P_{FA}=0.5\%$.

Leak Threshold: 0.10 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, fuel oil, and solvents.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be between 50 and 95% full.

Waiting Time: Minimum waiting time between delivery to the tank and test data collection must be 6 hours.
Minimum waiting time after normal pumping must be 4 hours.

Test Period: The minimum data collection time must be 6 hours.
Test data is acquired and recorded by a computer.
Leak rate is calculated as the difference between first and last data collected, divided by elapsed time between first and last volume changes observed.
There must be no dispensing or product delivery during the test.

Temperature: A minimum of 3 Resistance Temperature Detectors must be used to determine the average temperature of the stored hazardous substance.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 0.99 inches.
Minimum detectable change in water level is 0.01 inches.

Calibration: Temperature sensors and probe must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment only tests the portion of the tank that contains product.
As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).

Andover Controls Corporation
300 Brickstone Corporation
Andover, MA 01810
Tel: (508) 470-0555

Evaluator: Ken Wilcox Associates

Date of Evaluation: 2/3/92

X-76 ETM & X-76 ETM-4X

AUTOMATIC TANK GAUGING SYSTEM

Certification:	Leak rate of 0.2 gallon per hour with $P_D = 99.96\%$ & $P_{FA} = 0.044\%$.
Leak Threshold:	0.1 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
Applicability:	Gasoline, diesel, aviation fuel, fuel oil #4, solvents, waste oil, and other substances with specific gravity > 0.60 and viscosity < 1500 cp.
Capacity:	The maximum tank capacity is 15,000 gallons. The tank must be between 10 and 95% full.
Waiting Time:	Minimum waiting time between product delivery and test data collection must be 2 hours. There must be no dispensing or product delivery during the test waiting time.
Test Period:	The minimum data collection time must be 4 hours. Test data must be acquired and recorded by a computer. Leak rate calculated from data determined to be statistically valid.
Temperature:	Minimum of 1 resistance temperature detector must be used to determine the average temperature of the stored substance.
Water Sensor:	A water sensor must be used to detect water incursion. Minimum water level detectable in the tank is 0.947 inches. Minimum detectable water level change is 0.0254 inches.
Calibration:	Temperature sensors and probes must be checked and calibrated annually in accordance with manufacturer's instructions.
Comments:	This equipment was not evaluated using manifolded tanks. This equipment tests only that portion of the tank which contains product. As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure). Change in product volume is measured using magnetostrictive probe. This system is identical to Patriot Sensor's 7021 Digital Tank Gauge. X76ETM-4X console has different housing which allows it to be mounted outside.

API/Ronan
2300 E. Artesia Blvd.
Long Beach, CA 90805-4113
(310) 984-5380

Evaluator: Ken Wilcox Associates

Date of Evaluation: 02-07-91

X-76 ETM & X-76 ETM-4X

AUTOMATIC TANK GAUGING SYSTEM

Certification:	Leak rate of 0.1 gallon per hour with $P_D = 95.34\%$ & $P_{FA} = 4.66\%$.
Leak Threshold:	0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
Applicability:	Gasoline, diesel, aviation fuel, fuel oil #4, solvents, waste oil, and other substances with specific gravity > 0.60 and viscosity < 1500 cp.
Capacity:	The maximum tank capacity is 15,000 gallons. The tank must be between 10 and 95% full.
Waiting Time:	Minimum waiting time between product delivery and test data collection must be 8 hours. There must be no dispensing or product delivery during the test waiting time.
Test Period:	The minimum data collection time must be 4 hours. Test data must be acquired and recorded by a computer. Leak rate calculated from data determined to be statistically valid.
Temperature:	Minimum of 1 resistance temperature detector must be used to determine the average temperature of the stored substance.
Water Sensor:	A water sensor must be used to detect water incursion. Minimum water level detectable in the tank is 0.947 inches. Minimum detectable water level change is 0.0254 inches.
Calibration:	Temperature sensors and probes must be checked and calibrated annually in accordance with manufacturer's instructions.
Comments:	This equipment was not evaluated using manifolded tanks. This equipment tests only that portion of the tank which contains product. As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure). Change in product volume is measured using magnetostrictive probe. This system is identical to Patriot Sensor's 7021 Digital Tank Gauge. X76ETM-4X console has different housing which allows it to be mounted outside.

API/Ronan
2300 E. Artesia Blvd.
Long Beach, CA 90805-4113
(310) 984-5380

Evaluator: Ken Wilcox Associates

Date of Evaluation: 11-21-91

**Ronan X-76 Automatic Line Leak Detector
ver. X-76 DM-4 Microprocessor and JT-H2 Line Pressure Sensor**

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

- Certification:** Leak rate of 3.0 gallon per hour with $P_0 = 100\%$ & $P_{FA} = 0\%$.
- Leak Threshold:** 0.831 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4 & #6, solvent, and waste oil.
- Specification:** System is installed on pressurized fiberglass and steel pipelines.
The piping system volume must not exceed 45 gallons.
Tests are conducted at the line operating pressure.
The mechanical line leak detector must be removed from the pipeline system.
- Waiting Time:** No waiting time between last delivery of the product to the tank and the start of data collection.
No waiting time between last dispensing of product through the pipeline and the start of data collection for the test.
- Test Period:** The minimum data collection time (response time) for the test must be 20 seconds.
Test data must be acquired and recorded by a permanently installed microprocessor.
Calculations are automatically done by the microprocessor.
- System Features:** This system is permanently installed on the pipeline and automatically tests the line;
uses a preset threshold and a single test to determine whether the pipeline is leaking.
If a leak is declared, this system displays a message, triggers an alarm, and shuts down the dispensing system.
- Calibration:** Sensor must be checked and calibrated annually in accordance with manufacturer's instructions.

API/Ronan
2300 East Artesia Blvd.
Long Beach, CA 91355
Tel: (800) 634-0085

Evaluator: Midwest Research Institute

Date of Evaluation: 10/4/91

**Ronan X-76 Automatic Line Leak Detector
ver. X-76 DM-4 Microprocessor and JT-H2 Line Pressure Sensor**

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

- Certification:** Leak rate of 0.1 gallon per hour with $P_0 = 100\%$ and $P_{FA} = 0\%$.
- Leak Threshold:** 0.066 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4 & #6, solvent, and waste oil.
- Specification:** System is installed on pressurized fiberglass and steel pipelines.
The piping system volume must not exceed 45 gallons.
Tests are conducted at the line operating pressure.
The mechanical line leak detector must be removed from the pipeline system.
- Waiting Time:** No waiting time between last delivery of the product to the tank and the start of data collection.
Waiting time between last dispensing of product through the pipeline and the start of data collection for the test must be 2 hours.
- Test Period:** Minimum data collection time (response time) for the test must be 20 minutes.
Test data must be acquired and recorded by a permanently installed microprocessor.
Calculations are automatically done by the microprocessor.
- System Features:** This system is permanently installed on the pipeline and automatically tests the line.
Uses a preset threshold and a single test to determine whether the pipeline is leaking.
If a leak is declared, this system displays a message, triggers an alarm, and shuts down the dispensing system.
- Calibration:** Sensor must be checked and calibrated annually in accordance with manufacturer's instructions.

API/Ronan
2300 East Artesia Blvd.
Long Beach, CA 91355
Tel: (800) 634-0085

Evaluator: Midwest Research Institute

Date of Evaluation: 10-04-91

**Encompass MTS IPAM
(Magnetostrictive Probe)**

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.2 gallon per hour $P_D = 97.80\%$ & $P_{FA} = 2.20\%$.

Leak Threshold: 0.10 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, Diesel, Aviation Fuel, Fuel Oil #4, Fuel Oil #6, Solvents, Waste Oil, and other products which are compatible with the probe.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be at least 50% full.

Waiting Time: The minimum waiting period between delivery to the tank and test data collection must be 3 hours.

Test Period: The minimum data collection time must be 6 hours.
Test data must be acquired and recorded by a computer.
Leak rate is calculated from data determined to be valid by statistical analysis.
There must be no dispensing or product delivery during the test.

Temperature: A minimum of 5 Resistance Temperature Detectors must be used to determine the average temperature of the stored substance.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 1.29 inches.
Minimum change in water level that can be detected is 0.0034 inches.

Calibration: Temperature sensors and probe must be annually checked and calibrated in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment only tests that portion of the tank which contains product.
As the product level is lowered, the leak rate in a leaking tank decreases (due to lower head pressure).
Encompass software provides for remote access capabilities.

Arizona Instrument Corp.
4114 East Wood Street
Phoenix, Arizona 85040
Tel: (800) 528-7411

Evaluator: Ken Wilcox Associates

Date of Evaluation: 08/22/94

**Encompass USF IPAM
(Ultrasonic Probe)**

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.2 gallon per hour with $P_D = 99.94\%$ & $P_{FA} = 2.06\%$.

Leak Threshold: 0.10 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, Diesel, Aviation Fuel, Fuel Oil #4, Fuel Oil #6, Solvents, Waste Oil, and other products which are compatible with the probe.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be at least 50% full.

Waiting Time: The minimum waiting period between delivery to the tank and test data collection must be 3 hours.

Test Period: The minimum data collection time must be 6 hours.
Test data must be acquired and recorded by a computer.
Leak rate is calculated from data determined to be valid by statistical analysis.
There must be no dispensing or product delivery during the test.

Temperature: A single non-circulating sensor measures change in ultrasonic wave velocity to determine the average temperature of the stored substance.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 1.88 inches.
Minimum change in water level that can be detected is 0.012 inches.

Calibration: Temperature sensors and probes must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment only tests that portion of the tank which contains product.
As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).
Encompass software provides for remote access capabilities.

Arizona Instrument Corp.
4114 East Wood Street
Phoenix, AZ 85040
Tel: (800) 528-7411

Evaluator: Ken Wilcox Associates

Date of Evaluation: 08/22/94

DRAFT

Arizona Instrument Corporation

Soil Sentry Liquid 330
17-330-A/17-330-B, Probes 17-141A, 17-142A, 17-143A, 17-144A

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: refraction

Test Results:

	Commercial Gasoline	Synthetic Gasoline	#2 Diesel	Water
Accuracy (%)	100	100	Not Det.	Not Det.
Detection time (min:sec)	00:03	00:03	Not Det.	Not Det.
Fall Time (hr:min:sec)	Manual reset	Manual reset	Not Det.	Not Det.
Lower detection limit (cm):				
17-141A	0.25	0.28	0.15	0.10
17-142A	0.25	0.30	0.18	0.18
17-143A	0.03	0.15	0.03	0.13
17-144A	0.28	0.30	0.30	0.15

Specificity Results:

Activated: commercial gasoline, n-Hexane, diesel fuel, Jet-A fuel, toluene*, synthetic gasoline, xylene(s), water.

* only 17-143A was tested with toluene.

Manufacturer's Specifications:

Comments:

EPA and many states require detection of 1/8 inch of product, which is 0.32 cm, for ground water monitoring. The detectors are listed as interstitial due to intended use. Evaluation followed a combination of EPA's "Standard Test Procedures for Evaluating Leak Detection Methods: Liquid-Phase Out-of-Tank Product Detectors" and EPA's "Standard Test Procedures for Evaluating Leak Detection Methods: Nonvolumetric Tank Tightness Testing Methods." These detectors are reusable.

Arizona Instrument Corporation
4114 East Wood St.
Phoenix, AZ 85040-1941
(602)470-1414

Evaluator: Ken Wilcox Associates

Date of Evaluation: 12-29-92

DRAFT

Arizona Instrument Corporation

TLM-830
Probes 17-141A, 17-142A, 17-143A, 17-144A

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: refraction

Test Results:

	Commercial Gasoline	Synthetic Gasoline	#2 Diesel	Water
Accuracy (%)	100	100	Not Det.	Not Det.
Detection time (min:sec)	00:03	00:03	Not Det.	Not Det.
Fall Time (hr:min:sec)	Manual reset	Manual reset	Not Det.	Not Det.
Lower detection limit (cm):				
17-141A	0.25	0.28	0.15	0.10
17-142A	0.25	0.30	0.18	0.18
17-143A	0.03	0.15	0.03	0.13
17-144A	0.28	0.30	0.30	0.15

Specificity Results:

Activated: commercial gasoline, n-Hexane, diesel fuel, Jet-A fuel, toluene*, synthetic gasoline, xylene(s), water.

* only 17-143A was tested with toluene.

Manufacturer's Specifications:

Comments:

EPA and many states require detection of 1/8 inch of product, which is 0.32 cm, for ground water monitoring. The detectors are listed as interstitial due to intended use. Evaluation followed a combination of EPA's "Standard Test Procedures for Evaluating Leak Detection Methods: Liquid-Phase Out-of-Tank Product Detectors" and EPA's "Standard Test Procedures for Evaluating Leak Detection Methods: Nonvolumetric Tank Tightness Testing Methods." These detectors are reusable.

Arizona Instrument Corporation
4114 East Wood St.
Phoenix, AZ 85040-1941
(602)470-1414

Evaluator: Ken Wilcox Associates

Date of Evaluation: 01-08-93

DRAFT

VAPOR PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: quantitative
 Sampling frequency: continuous
 Operating principle: metal oxide semiconductor

Test Results:

	Commercial Gasoline	Synthetic Gasoline	JP-4	JP-5
Accuracy* (%):	170	120	120	Not det.
Bias* (%):	60	8.0	1.8	Not det.
Precision* (%):	6.3	7.7	18	Not det.
Detection Time (min:sec):	12:20	12:27	12:33	Not det.
Fall Time* (min:sec):	11:53	11:53	11:55	Not det.
Lower Detection Limit (ppm):	150	140	60	92**

* For tests conducted with 1000 ppm of test gas.

** Testing was done using a JP-5 concentration on 90 ppm in humidified air.

Specificity Results (%):

Commercial gasoline	170
n-Hexane	110
JP-4 jet fuel	90
Synthetic gasoline	110
Toluene	43
Xylene(s)	22

Manufacturer's Specifications:

Comments: The test procedures used were those in Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods," June 29, 1990. Please note there is another specification sheet for this system, regarding a separate evaluation.

Arizona Instrument Corporation
 4114 East Wood St.
 Phoenix, AZ 85040-1941
 (602)470-1414

Evaluator: Radian Corporation

Date of Evaluation: 12-28-90

Date of Evaluation, JP-5 only: 04-17-91

DRAFT

VAPOR PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: quantitative
 Sampling frequency: continuous
 Operating principle: metal oxide semiconductor

Test Results:

	Diesel Fuel	JP-8
Accuracy (%):	Not determined	Not determined
Bias:	-20 ppm @ 50 ppm	Not determined
Precision:	12 ppm	Not determined
Detection Time (min):	15	15
Fall Time (min):	15	15
Lower Detection Limit:	10 ppm	<0.01 gal/hr

Specificity Results*:

Activated: Diesel Fuel, JP-8

* A limited number of tests were conducted to determine the response of the system to Diesel and JP-8.

Manufacturer's Specifications:

Comments: The test procedures used were modified from EPA's "Standard Test Procedures for Evaluation Leak Detection Methods: Vapor-Phase Out-of-Tank Product Detectors," March 1990, and Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods," June 6, 1990. Please note there is another specification sheet for this system, regarding a separate evaluation.

Arizona Instrument Corporation
 4114 East Wood St.
 Phoenix, AZ 85040-1941
 (602)470-1414

Evaluator: Ken Wilcox Associates

Date of Evaluation: 02-16-92

AES System II (Overfilled Test)

VOLUMETRIC TANK TIGHTNESS TEST METHOD

Certification:	Leak rate of 0.1 gallon per hour with $P_D = 97.7\%$ & $P_{TA} = 2.3\%$.
Leak Threshold:	0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
Applicability:	Gasoline, diesel, aviation fuel, fuel oil, waste oil, and solvents.
Capacity:	Maximum tank capacity is 15,000 gallons. The tank must be at least 100% full.
Waiting time:	Waiting period between delivery and the beginning of the test included in waiting period after "topping off". Waiting time between "topping off" and beginning the test is computer-dictated by real-time analysis of level and temperature data. Waiting time is generally 4 to 12 hours. There must be no dispensing or product delivery during the test waiting time.
Test Period:	The minimum data collection time is 2 hours (two one-hour tests). Test data must be acquired and recorded by a computer. Leak rate is calculated from the data of last 1.5 hours of test period. There must be no dispensing or product delivery during the test.
Temperature:	A minimum of 5 temperature sensors must be used to determine the average temperature of the stored hazardous substance.
Ground Water:	Depth to the water table present in the backfill must be determined, and if it is above the bottom of the tank, product level must be adjusted to provide minimum of 2 psi net pressure on the bottom of the tank during the test.
Calibration:	Level sensors must be calibrated before each test in accordance with manufacturer's instructions. Temperature sensor must be calibrated annually in accordance with manufacturer's instructions.
Comments:	This equipment was not evaluated using manifolded tanks.

Associated Environmental Systems, Inc.
3101 N. Sillect, Suite 105
Bakersfield, CA 93308
Tel: (805) 326-1073

Evaluator: Vista Research

Evaluation Completed: 12-20-90

AES System II (Overfilled Test - Large Tanks)

VOLUMETRIC TANK TIGHTNESS TEST METHOD

Certification:	Leak rate of 0.1 gallon per hour with $P_D = 98.9\%$ & $P_{TA} = 1.1\%$.
Leak Threshold:	0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
Applicability:	Gasoline, diesel, aviation fuel, fuel oil, waste oil, and solvents.
Capacity:	The maximum tank capacity is 75,000 gallons. The tank must be 100% full.
Waiting Time:	Minimum waiting time after adding any substantial amount of product to the tank is 24 hours. Waiting time between "topping off" and beginning the test is computer-dictated by real-time analysis of level and temperature data and must be at least 1 hour. There must be no dispensing or product delivery during the test waiting time.
Test Period:	The minimum data collection time must be 4 hours. Test data must be acquired and recorded by a computer. Leak rate is calculated from the data of 3 hours of test period. There must be no dispensing or product delivery during the test.
Temperature:	A minimum of 12 thermistors must be used to determine the average temperature of the stored hazardous substance.
Ground Water:	Depth to the water table present in the backfill must be determined, and if it is above the bottom of the tank, product level must be adjusted to provide minimum of 2 psi net pressure on the bottom of the tank during the test.
Calibration:	Level sensors must be calibrated before each test in accordance with manufacturer's instructions. Temperature sensors must be calibrated annually in accordance with manufacturer's instructions.
Comments:	This equipment was not evaluated using manifolded tanks.

Associated Environmental, Inc.
3101 N. Sillect, Suite 105
Bakersfield, CA 93308
Tel: (805) 326-0173

Evaluator: Ken Wilcox Associates

Date of Evaluation: 02-28-92

LINE TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gallon per hour with $P_0 = 100\%$ & $P_{FA} = 0\%$.

Leak Threshold: 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, fuel oil, waste oil, and solvents.

Capacity: System tests fiberglass and steel piping.
The piping system volume must not exceed 80 gallons.
Tests are conducted at 150% of the line operating pressure.
Mechanical line leak detector must be removed from the piping system being tested.

Waiting Time: There is no waiting period between delivery and testing.
Minimum waiting time between last dispensing and testing is 1 hour.

Test Period: The minimum data collection time must be 30 minutes.
Test data must be acquired and recorded manually.
Two tests with zero time between the tests are required before a leak can be declared.

Calibration: Equipment must be calibrated annually in accordance with manufacturer's instructions.

Associated Environmental System, Inc.
3010 N. Street, Suite 106
Bakersfield, CA 93308
Tel: (805) 326-0173

Evaluator: Vista Research

Date of Evaluation: 11/21/80

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

Certification: Leak rate of 3 gallons per hour with $P_0 = 96.2\%$ & $P_{FA} = 0\%$.

Leak Threshold: 2.36 gallons per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuels #4 & #6, waste oil, kerosene, and solvents.

Specifications: System is installed on pressurized fiberglass and/or steel piping.
The piping system must not exceed 35.36 gallons.
Tests are conducted at the line operating pressure.

Waiting Time: There is no waiting time between product delivery and testing.
There is no waiting time between last dispensing and testing.

Test Period: Minimum data collection time is 10 seconds.
Test data is acquired and recorded by the microprocessor.

Calibration: Manufacturer recommends a weekly self check, activated by the operator, and a full functional test every 30 days, estimated to take 5 minutes to perform.

System Features: This system is permanently installed on the piping and automatically tests the line.
It uses a preset threshold and a single test to determine whether the pipeline is leaking.
If a leak is declared, this system will energize an indicator light, trigger an audible alarm, and shut down the dispensing system.

Campo/Miller, Inc.
P. O. Box 1809
Porterville, CA 93258
(209) 781-6862

Evaluator: Jetronix Engineering Laboratories
Evaluation Date: 06-01-91
Reviewed by: Ken Wilcox Associates
Review Date: 09-08-94

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

Certification: Leak rate of 3 gallons per hour with $P_D = 96.2\%$ & $P_{FA} = 0\%$.

Leak Threshold: 2.36 gallons per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuels #4 & #6, waste oil, kerosene, and solvents.

Specifications: System is installed on pressurized fiberglass and/or steel piping.
The piping system must not exceed 35.36 gallons.
Tests are conducted at the line operating pressure.

Waiting Time: There is no waiting time between product delivery and testing.
There is no waiting time between last dispensing and testing.

Test Period: Minimum data collection time is 10 seconds, but can be adjusted between 10 and 150 seconds depending on the bulk modulus of the piping system.
Test data is acquired and recorded by the microprocessor.

Calibration: Manufacturer recommends a weekly self check, activated by the operator, and a full functional test every 30 days, estimated to take 5 minutes to perform.

System Features: This system is permanently installed on the piping and automatically tests the line.
It uses a preset threshold and a single test to determine whether the pipeline is leaking.
If a leak is declared, this system will energize an indicator light, trigger an audible alarm, and shut down the dispensing system.

Campo/Miller, Inc.
P. O. Box 1809
Porterville, CA 93258
(209) 781-6862

Evaluator: Jetronix Engineering Laboratories
Evaluation Date: 06-01-91
Reviewed by: Ken Wilcox Associates
Review Date: 09-09-94

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

Certification: Leak rate* of 3 gallons per hour with $P_D = 96.2\%$ & $P_{FA} = 0\%$.

Leak Threshold: 2.36 gallons per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuels #4 & #6, waste oil, kerosene, and solvents.

Specifications: System is installed on pressurized fiberglass and/or steel piping.
The piping system must not exceed 35.36 gallons.
Tests are conducted at the line operating pressure.

Waiting Time: There is no waiting time between product delivery and testing.
There is no waiting time between last dispensing and testing.

Test Period: Minimum data collection time is 10 seconds, but can be adjusted between 10 and 150 seconds depending on the bulk modulus of the piping system.
Test data is acquired and recorded by the microprocessor.

Calibration: System must be calibrated annually in accordance with manufacturer's instructions.

System Features: This system is permanently installed on the piping and automatically tests the line.
It uses a preset threshold and a single test to determine whether the pipeline is leaking.
If a leak is declared, this system will energize an indicator light, trigger an audible alarm, and shut down the dispensing system.

* The LS300-120 PLUS & LS300-120 PLUS A/S have additional leak detection capabilities, which are under review.

Campo/Miller, Inc.
P. O. Box 1809
Porterville, CA 93258
(209) 781-6862

Evaluator: Jetronix Engineering Laboratories
Evaluation Date: 06-01-91
Reviewed by: Ken Wilcox Associates
Review Date: 09-09-94

Control Engineers

Line Leak Detector
Model LLP1

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gallons per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.

Leak Threshold: 1.88 gallons per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, and aviation fuel.

Specification: System is installed on pressurized fiberglass and steel piping. The piping system volume must not exceed 89 gallons. Tests are conducted at the line operating pressure.

Waiting Time: No waiting period between product delivery and testing. No waiting period between last dispensing and testing.

Test Period: Data collection time (response time) is about 10 seconds. Test data must be acquired and recorded by permanently installed microprocessor. Calculations are automatically done by the microprocessor.

System Features: This system is permanently installed on the piping and automatically tests the line. It uses a preset threshold and a single test to determine whether the piping is leaking. If a leak is declared, this system displays a message, triggers an alarm, and shuts down the dispensing system.

Calibration: Sensor must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: This equipment is no longer produced by Control Engineers.

Control Engineers
P. O. Box 9037
114 Menard Road
Houma, LA 70361
Tel: (504) 872-4541

Evaluator: Midwest Research Institute

Date of Evaluation: 08/07/91

Control Engineers

Line Leak Detector
Model LLP2

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gallons per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.

Leak Threshold: 1.88 gallons per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, and aviation fuel.

Specification: System is installed on pressurized fiberglass and steel piping. The piping system volume must not exceed 89 gallons. Tests are conducted at the line operating pressure.

Waiting Time: No waiting period between product delivery and testing. No waiting period between last dispensing and testing.

Test Period: Data collection time (response time) is about 10 seconds. Test data must be acquired and recorded by permanently installed microprocessor. Calculations are automatically done by the microprocessor.

System Features: This system is permanently installed on the piping and automatically tests the line. It uses a preset threshold and a single test to determine whether the piping is leaking. If a leak is declared, this system displays a message, triggers an alarm, and shuts down the dispensing system.

Calibration: Sensor must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: This equipment is no longer produced by Control Engineers.

Control Engineers
P. O. Box 9037
114 Menard Road
Houma, LA 70361
Tel: (504) 872-4541

Evaluator: Midwest Research Institute

Date of Evaluation: 08/07/91

Control Engineers

Line Leak Detector
Model LLP2

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

Certification: Leak rate of 0.1 gallon per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.

Leak Threshold: 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, and aviation fuel.

Specification: System is installed on pressurized fiberglass and steel piping. The piping system volume must not exceed 89 gallons. Tests are conducted at the line operating pressure.

Waiting Time: There is no waiting period between product delivery and testing. Minimum waiting period between dispensing of product through the piping and testing is 15 minutes.

Test Period: Minimum data collection time is 30 minutes. Test data must be acquired and recorded by permanently-installed microprocessor. Calculations are automatically done by the microprocessor.

System Features: This system is permanently installed on the piping and automatically tests the line. It uses a preset threshold and a single test to determine whether the piping is leaking. If a leak is declared, this system displays a message, triggers an alarm, and shuts down the dispensing system.

Calibration: Sensor must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: This equipment is no longer produced by Control Engineers.

Control Engineers
P. O. Box 9037
114 Menard Road
Houma, LA 70361
Tel: (504) 872-4541

Evaluator: Midwest Research Institute

Date of Evaluation: 08/07/91

EBW, Inc.

EBW Auto-Stik II and Auto-Stik Jr.

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.2 gph with $P_D = 99.9\%$ & $P_{FA} = 0.1\%$.

Leak Threshold: 0.10 gallons per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, Diesel, Aviation Fuel, Fuel Oil #4, Fuel Oil #6, Solvents, and other compatible products with known coefficients of expansion and densities.

Capacity: The maximum tank capacity is 15,000 gallons. The tank must be at least 50% full.

Waiting Time: The minimum waiting period between delivery and testing is 6 hours. The minimum waiting period between dispensing and testing is 6 hours. There must be no product delivery during the test waiting time.

Test Period: The minimum data collection time must be 4 hours. The test data must be acquired and recorded by a computer. Leak rate is calculated from average of subsets of all data collected. There must be no dispensing or product delivery during the test.

Temperature: Minimum of 5 Thermistors must be used to determine the average temperature of the stored regulated substance.

Water Sensor: A water sensor must be used to detect water incursion. Minimum water level detectable in the tank is 0.49 inches. Minimum detectable water level change is 0.0052 inches.

Calibration: Temperature sensor and probe must be checked and calibrated in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks. This equipment only tests the portion of the tank that contains product. As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure). Auto Stik Jr. is used with up to 4 magnetostrictive probes and can handle up to 8 input sensors. Auto Stik II is used with up to 16 magnetostrictive probes and can handle up to 64 input sensors.

EBW, INC.
2814 McCracken Avenue
Muskegon, MI 49443
Tel: (800) 475-5151

Evaluator: Ken Wilcox Associates

Date of Evaluation: 08-20-93

EBW Auto-Stik II and Auto-Stik Jr.

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.1 gallon per hour with $P_D = 98.3\%$ & $P_{FA} = 1.7\%$.

Leak Threshold: 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4, fuel oil #6, solvents, and other compatible products with known coefficients of expansion and densities.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be between 50 and 95% full.

Waiting Time: Minimum waiting time between delivery to the tank and test data collection must be 6 hours.

Test Period: The minimum data collection time must be 4 hours.
The test data must be acquired and recorded by a computer.
Leak rate is calculated from average of subsets of all data collected.
There must be no dispensing or product delivery during the test.

Temperature: Minimum of 5 thermistors must be used to determine the average temperature of the stored product.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 0.49 inches.
Minimum detectable water level change is 0.0052 inches.

Calibration: Temperature sensor and probe must be checked and calibrated in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment only tests the portion of the tank that contains product.
As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).
Auto Stik Jr. is used with up to 4 magnetostrictive probes and can handle up to 8 input sensors.
Auto Stik II is used with up to 16 magnetostrictive probes and can handle up to 64 input sensors.

EBW, INC.
2814 McCracken Avenue
Muskegon, MI 49443
Tel: (800) 475-5151

Evaluator: Ken Wilcox Associates

Date of Evaluation: 08-20-93

E'SPI III

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.2 gallon per hour with $P_D = 97.9\%$ & $P_{FA} = 1.1\%$.

Leak Threshold: 0.075 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, and solvents.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be between 50 and 95% full.

Waiting Time: Minimum waiting time between delivery to the tank and test data collection must be 7 hours.

Test Period: Minimum data collection time must be 5.5 hours.
The test data must be acquired and recorded by a computer.
Leak rate is calculated from average of subsets of all collected data.
There must be no dispensing or product delivery during the test.

Temperature: A single moving quartz crystal temperature sensor must be used to determine the average temperature of the stored hazardous substance.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 0.253 inches.
Minimum change in water level that can be detected is 0.029 inches.

Calibration: Temperature sensor and probe must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment only tests the portion of the tank that contains product.
As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).

Egemin Naamloze Vennootschap
Bredabeek 1201 - 2900
Schoten, Belgium
Tel: 011-32-3-03/645 27 90

Evaluator: Midwest Research Institute

Date of Evaluation: 12/21/90

AUTOMATIC TANK GAUGING SYSTEM

Certification:	Leak rate of 0.2 gallon per hour with $P_D = 97.2\%$ & $P_{FA} = 0.3\%$.
Leak Threshold:	0.1 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
Applicability:	Gasoline, diesel, aviation fuel, fuel oil, and solvents.
Capacity:	The maximum tank capacity is 15,000 gallons. The tank must be between 50 and 95% full.
Waiting Time:	Minimum waiting time between product delivery to the tank and test data collection must be 6 hours.
Test Time:	The minimum data collection time must be 2 hours and 15 minutes. Test data must be acquired and recorded by a computer. Leak rate is calculated from average of subsets of all collected data. There must be no dispensing or product delivery during the test.
Temperature:	A minimum of 5 temperature sensors must be used to determine the average temperature of the stored hazardous substance.
Water Sensor:	A water sensor must be used to detect water incursion. Minimum water level detectable in the tank is 0.253 inches. Minimum change in water level that can be detected is 0.029 inches.
Calibration:	Temperature sensor and probe must be checked and calibrated annually in accordance with manufacturer's instructions.
Comments:	This equipment was not evaluated using manifolded tanks. This equipment only tests the portion of the tank that contains product. As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).

Egemin Naamloze Vennootschap
Bredabaan 1201 - 2900
Schoten, Belgium
Tel: 011-32-3-03/645 2790

Evaluator: Midwest Research Institute

Date of Evaluation: 12/21/90

AUTOMATIC TANK GAUGING SYSTEM

Certification:	Leak rate of 0.1 gallon per hour with $P_D = 99\%$ & $P_{FA} = 1\%$.
Leak Threshold:	0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
Applicability:	Gasoline, diesel, aviation fuel, fuel oil #4, solvents, waste oil, and other substances determined to be compatible with probe.
Capacity:	The maximum tank capacity is 15,000 gallons. The certification tests were done on a tank which was 50% & 95% full.
Waiting Time:	Minimum waiting time between delivery to the tank and test data collection must be 6 hours.
Test Period:	Minimum data collection time must be 3.75 hours The data is acquired and recorded by a microprocessor. Microprocessor automatically determines test time based on tank size and product level. Leak rate is calculated from data determined to be valid by statistical analysis. There must be no dispensing or product delivery during the test.
Temperature:	A minimum of 5 Resistance Temperature Detectors must be used to determine the average temperature of the stored substance.
Water Sensor:	A water sensor must be used to detect water incursion. Minimum water level detectable in the tank is 0.66 inches. Minimum detectable change in water level is 0.039 inches.
Calibration:	Temperature sensors and probe must be checked and calibrated annually in accordance with manufacturer's instructions.
Comments:	This equipment was not evaluated using manifolded tanks. This equipment tests that portion of the tank which contains product. As the product level is lowered, the leak rate in a leaking tank decreases (due to lower head pressure). A magnetostrictive probe is used to measure changes in product volume.

Emco Wheaton, Inc.
114 MacKenan Drive
Cary, NC 27511
Tel: (800) 342-6125

Evaluator: Midwest Research Institute

Date of Evaluation: 02-08-94

Emco Wheaton, Inc.

EECO System Series
(0.1 gph Quick Test)

AUTOMATIC TANK GAUGING SYSTEM

- Certification:** Leak rate of 0.1 gallon per hour with $P_D = 96\%$ & $P_{FA} = 4\%$.
- Leak Threshold:** 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, solvents, waste oil, and other substances determined to be compatible with probe.
- Capacity:** The maximum tank capacity is 15,000 gallons.
The certification tests were conducted on a tank which was 50% and 95% full.
- Waiting Time:** Minimum waiting time between delivery to the tank and test data collection must be 6 hours.
- Test Period:** The minimum data collection time is 1.7 hours.
The data is acquired and recorded by a microprocessor.
Microprocessor automatically determines test time based on tank size and product level.
Leak rate is calculated from data determined to be valid by statistical analysis.
There must be no dispensing or product delivery during the test.
- Temperature:** A minimum of 5 Resistance Temperature Detectors must be used to determine the average temperature of the stored substance.
- Water Sensor:** A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 0.66 inches.
Minimum detectable change in water level is 0.039 inches.
- Calibration:** Temperature sensors and probes must be checked and calibrated annually in accordance with manufacturer's instructions.
- Comments:** This equipment was not evaluated using manifolded tanks.
This equipment tests only that portion of the tank which contains product.
As the product level is lowered, the leak rate in a leaking tank decreases (due to lower head pressure).
A magnetostrictive probe is used to measure changes in product volume.

Emco Wheaton, Inc.
114 MacKenan Drive
Cary, NC 27511
Tel: (800) 342-6125

Evaluator: Midwest Research Institute

Date of Evaluation: 02-15-94

Emco Wheaton, Inc.

EECO System Series
(0.2 gph Precision Test)

AUTOMATIC TANK GAUGING SYSTEM

- Certification:** Leak rate of 0.2 gallon per hour with $P_D = 99.1\%$ & $P_{FA} = 0.9\%$.
- Leak Threshold:** 0.10 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4 & #6, solvents, waste oil, and other substances determined to be compatible with probe.
- Capacity:** The maximum tank capacity is 15,000 gallons.
The tank must be at least 50% full.
- Waiting Time:** Minimum waiting time between delivery to the tank and test data collection must be 6 hours.
- Test Period:** The minimum data collection time must be 1.90 hours.
Test data is acquired and recorded by the microprocessor.
Microprocessor automatically determines test time based on tank size and product level.
Leak rate is calculated from data determined to be valid by statistical analysis.
There must be no dispensing or product delivery during the test.
- Temperature:** A minimum of 5 Resistance Temperature Detectors must be used to determine the average temperature of the stored hazardous substance.
- Water Sensor:** A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 0.66 inches.
Minimum detectable change in water level is 0.039 inches.
- Calibration:** Temperature sensors and probe must be checked and calibrated annually in accordance with manufacturer's instructions.
- Comments:** This equipment was not evaluated using manifolded tanks.
This equipment only tests the portion of the tank that contains product.
As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).
A magnetostrictive probe measures changes in product volume.

Emco Wheaton, Inc.
114 MacKenan Drive
Cary, NC 27511
(800) 342-6125

Evaluator: Ken Wilcox Associates

Date of Evaluation: 12-23-93

AUTOMATIC TANK GAUGING SYSTEM

- Certification:** Leak rate of 0.2 gallon per hour with $P_D = 95.4\%$ & $P_{FA} = 4.6\%$.
- Leak Threshold:** 0.10 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4 & 6, solvents, waste oil, and other substances determined to be compatible with probe.
- Capacity:** The maximum tank capacity is 15,000 gallons.
The tank must be at least 50% full.
- Waiting Time:** Minimum waiting time between delivery to the tank and test data collection must be at least 1 hour and can range up to 6 hours depending upon tank conditions.
- Test Period:** Minimum data collection time must be at least 53 minutes.
Test data is acquired and recorded by a microprocessor.
Microprocessor automatically determines test time based on tank size and product level.
Leak rate is calculated from data determined to be valid by statistical analysis.
There must be no dispensing or product delivery during the test.
- Temperature:** A minimum of 5 Resistance Temperature Detectors must be used to determine the average temperature of the stored hazardous substance.
- Water Sensor:** A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 0.66 inches.
Minimum detectable change in water level that can be detected is 0.039 inches.
- Calibration:** Temperature sensors and probe must be annually checked and calibrated in accordance with manufacturer's instructions.
- Comments:** This equipment was not evaluated using manifolded tanks.
This equipment only tests the portion of the tank that contains product.
As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).
A magnetostrictive probe measures changes in product volume.

AUTOMATIC TANK GAUGING SYSTEM

- Certification:** Leak rate of 0.2 gallon per hour with $P_D = 99.1\%$ & $P_{FA} = 0.9\%$.
- Leak Threshold:** 0.10 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, solvents and waste oil. Contact manufacturer for other applications.
- Capacity:** The maximum tank capacity is 15,000 gallons.
The certification tests were conducted on a tank which was 50% and 95% full.
- Waiting Time:** Minimum waiting time between delivery to the tank and test data collection must be 6 hours.
- Test Period:** The minimum data collection time is 1.9 hours.
The data is acquired and recorded by a microprocessor.
Microprocessor automatically determines test time based on tank size and product level.
Leak rate is calculated from data determined to be valid by statistical analysis.
There must be no dispensing or product delivery during the test.
- Temperature:** A minimum of 5 Resistance Temperature Detectors must be used to determine the average temperature of the stored substance.
- Water Sensor:** A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 0.66 inches.
Minimum detectable change in water level is 0.039 inches.
- Calibration:** Temperature sensors and probes must be checked and calibrated annually in accordance with manufacturer's instructions.
- Comments:** This equipment was not evaluated using manifolded tanks.
This equipment tests only that portion of the tank which contains product.
As the product level is lowered, the leak rate in a leaking tank decreases (due to lower head pressure).

DRAFT

Emco Wheaton, Inc.

EECO System TLM Monthly Quick Test

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.2 gallon per hour with $P_D = 95.4\%$ & $P_{FA} = 4.6\%$.

Leak Threshold: 0.10 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4, solvents and waste oil. Contact manufacturer for other applications.

Capacity: The maximum tank capacity is 15,000 gallons.
The certification tests were conducted on a tank which was 50% and 95% full.

Waiting Time: Minimum waiting time between delivery to the tank and test data collection is variable and ranges between 1 and 6 hours.

Test Period: The minimum data collection time is 53 minutes.
The data is acquired and recorded by a microprocessor.
Microprocessor automatically determines test time based on tank size and product level.
Leak rate is calculated from data determined to be valid by statistical analysis.
There must be no dispensing or product delivery during the test.

Temperature: A minimum of 5 Resistance Temperature Detectors must be used to determine the average temperature of the stored substance.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 0.66 inches.
Minimum detectable change in water level is 0.039 inches.

Calibration: Temperature sensors and probes must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment tests only that portion of the tank which contains product.
As the product level is lowered, the leak rate in a leaking tank decreases (due to lower head pressure).

Emco Wheaton, Inc.
114 MacKenen Drive
Cary, NC 27511
Tel: (800) 342-6125

Evaluator: Ken Wilcox Associates

Date of Evaluation: 12-23-93

DRAFT

Emco Wheaton, Inc.

EECO System TLM Quick Precision

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.1 gallon per hour with $P_D = 96\%$ & $P_{FA} = 1\%$.

Leak Threshold: 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4, solvents and waste oil. Contact manufacturer for other applications.

Capacity: The maximum tank capacity is 15,000 gallons.
The certification tests were conducted on a tank which was 50% and 95% full.

Waiting Time: Minimum waiting time between delivery to the tank and test data collection must be 6 hours.

Test Period: The minimum data collection time is 3.75 hours.
The data is acquired and recorded by a microprocessor.
Microprocessor automatically determines test time based on tank size and product level.
Leak rate is calculated from data determined to be valid by statistical analysis.
There must be no dispensing or product delivery during the test.

Temperature: A minimum of 5 Resistance Temperature Detectors must be used to determine the average temperature of the stored substance.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 0.66 inches.
Minimum detectable change in water level is 0.039 inches.

Calibration: Temperature sensors and probes must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment tests only that portion of the tank which contains product.
As the product level is lowered, the leak rate in a leaking tank decreases (due to lower head pressure).

Emco Wheaton, Inc.
114 MacKenen Drive
Cary, NC 27511
Tel: (800) 342-6125

Evaluator: Midwest Research Institute

Date of Evaluation: 02-08-94

Emco Wheaton, Inc

EECO System TLM Quick Test

AUTOMATIC TANK GAUGING SYSTEM

- Certification:** Leak rate of 0.1 gallon per hour with $P_D = 96\%$ & $P_{FA} = 4\%$.
- Leak Threshold:** 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, solvents, waste oil. Contact manufacturer for other applications.
- Capacity:** The maximum tank capacity is 15,000 gallons.
The tests were conducted at on a tank which was 50% and 95% full.
- Waiting Time:** Minimum waiting time between delivery to the tank and test data collection must be 6 hours.
- Test Period:** The minimum data collection time is 1.7 hours.
The data is acquired and recorded by a microprocessor.
Microprocessor automatically determines test time based on tank size and product level.
Leak rate is calculated from data determined to be valid by statistical analysis.
There must be no dispensing or product delivery during the test.
- Temperature:** A minimum of 5 Resistance Temperature Detectors must be used to determine the average temperature of the stored substance.
- Water Sensor:** A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 0.66 inches.
Minimum detectable change in water level is 0.039 inches.
- Calibration:** Temperature sensors and probes must be checked and calibrated annually in accordance with manufacturer's instructions.
- Comments:** This equipment was not evaluated using manifolded tanks.
This equipment tests only that portion of the tank which contains product.
As the product level is lowered, the leak rate in a leaking tank decreases (due to lower head pressure).

Emco Wheaton, Inc.
114 MacKenan Drive
Cary, NC 27511
Tel: (800) 342-6125

Evaluator: Midwest Research Institute

Date of Evaluation: 02-15-94

Emco Wheaton, Inc

EECO System LLD - Hourly Monitoring Test

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

- Certification:** Leak rate of 3.0 gallon per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.
- Leak Threshold:** 2.0 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4. Contact manufacturer for other applications.
- Specification:** System is installed on pressurized fiberglass and steel piping.
The piping system volume must not exceed 67.4 gallons.
Tests are conducted at 10 psi pressure.
- System may be installed on flexible pipeline systems.
The Flex line system volume must not exceed 49.6 gallons.
Tests are conducted at an average pressure of 10 psi.
- Test Period:** Data collection time for the test is at least 2 hours.
Test data acquired and recorded by microprocessor.
Calculations are automatically done with the microprocessor.
- System Features:** This system is permanently installed on the piping and automatically tests the line.
It uses a preset threshold and a single test to determine whether the piping is leaking.
If a leak is declared the system shuts down the dispensing system, displays and prints a message, and triggers an alarm.
- Calibration:** Equipment must be checked and calibrated annually in accordance with manufacturer's instructions.

Emco Wheaton, Inc
114 MacKenan Drive
Cary, NC 27511
(800) 342-6125

Evaluator: Ken Wilcox Associates

Date of Evaluation: 7/18/94

DRAFT

Emco Wheaton, Inc

EECO System LLD - Monthly Monitoring Test

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

- Certification:** Leak rate of 0.2 gallon per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.
- Leak Threshold:** 0.1293 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4. Contact manufacturer for other applications.
- Specification:** System is installed on pressurized fiberglass and steel piping. The piping system volume must not exceed 67.4 gallons. Tests are conducted at 10 psi pressure.
- System may be installed on flexible pipeline systems. The flex line system volume must not exceed 49.6 gallons. Tests are conducted at an average pressure of 10 psi.
- Test Period:** Data collection time for the test is at least 9 minutes. Test data acquired and recorded by microprocessor. Calculations are automatically done with the microprocessor.
- System Features:** This system is permanently installed on the piping and automatically tests the line. It uses a preset threshold and a single test to determine whether the piping is leaking. If a leak is declared the system shuts down the dispensing system, displays and prints a message, and triggers an alarm.
- Calibration:** Equipment must be checked and calibrated annually in accordance with manufacturer's instructions.

Emco Wheaton, Inc
114 MacKenan Drive
Cary, NC 27511
(800) 342-6125

Evaluator: Ken Wilcox Associates, Inc.

Date of Evaluation: 7/18/94

DRAFT

Emco Wheaton, Inc

EECO System LLD - Line Tightness Test

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

- Certification:** Leak rate of 0.1 gallon per hour with $P_D = 100\%$ & $P_{FA} = 0\%$
- Leak Threshold:** 0.0793 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4. Contact manufacturer for other applications.
- Specification:** System is installed on pressurized fiberglass and steel piping. The piping system volume must not exceed 67.4 gallons. Tests are conducted at 10 psi pressure.
- Systems may be installed on flexible pipeline systems. The flex line system volume must not exceed 49.6 gallons. Tests are conducted at an average pressure of 10 psi.
- Test Period:** Data collection time for the test is at least 31 minutes. Test data acquired and recorded by microprocessor. Calculations are automatically done with the microprocessor.
- System Features:** This system is permanently installed on the piping and automatically tests the line. It uses a preset threshold and a single test to determine whether the piping is leaking. If a leak is declared the system shuts down the dispensing system, displays and prints a message, and triggers an alarm.
- Calibration:** Equipment must be checked and calibrated annually in accordance with manufacturer's instructions.

Emco Wheaton, Inc
114 MacKenan Drive
Cary, NC 27511
(800) 342-6125

Evaluator: Ken Wilcox Associates

Date of Evaluation: 7/18/94

Engineered Systems, Inc.

Image II

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.2 gallon per hour with $P_D = 96.6\%$ & $P_{FA} = 3.4\%$.

Leak Threshold: 0.1 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, and solvents.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be at least 90% full.

Waiting Time: Minimum waiting time between product delivery to the tank and test data collection must be 8 hours.

Test Period: The minimum data collection time must be 6 hours.
Test data must be acquired and recorded by a computer.
Leak rate is calculated from average of subsets of all collected data.
There must be no dispensing or product delivery during the test.

Temperature: Minimum of 5 Resistance Temperature Detectors must be used to determine the average temperature of the stored hazardous product.

Water Sensor: A water sensor must be used to monitor changes in water level in tank during test.
Minimum water level detectable in the tank is 0.83 inches.
Minimum detectable water level change is 0.0116 inches.

Calibration: Temperature sensors and probe must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment only tests the portion of the tank that contains product.
As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).
This system is identical to Universal Sensor's TICS-1000 ATGS.

Engineered Systems Inc.
2001 West Campus Drive
Tempe, AZ 85282
Tel: (602) 438-1382

Evaluator: Ken Wilcox Associates, Inc.

Date of Evaluation: 08-20-93

Entropy Limited

Precision Tank Inventory Control System, Version 90
(qualitative)

STATISTICAL INVENTORY RECONCILIATION TEST METHOD

Certification: Method is certified to detect a 0.10 gph leak rate with a $P_D = 97.9\%$ and $P_{FA} = 0\%$.

Leak Threshold: A leak is declared when leak rate exceeds 0.04 gallons per hour.

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4.

Tank Capacity: Maximum tank capacity may not exceed 30,000 gallons.

Data Requirement: Minimum 64 days of product level and flowthrough data.

Comments: Of 120 data sets submitted for analysis, 13 were not evaluated and 16 were inconclusive.

The median throughput for tanks used in this evaluation was 42,835 gallons per month.

This evaluation did not include data from manifolded tanks.

Data sets used in this evaluation were supplied by the evaluator.

Entropy Limited
South Great Rd.
Lincoln, MA 01773
Tel: (617) 256-8901

Evaluator: Midwest Research Institute

Date of Evaluation: 04/02/91

Precision Tank Inventory Control System Rev. 90
(quantitative)

STATISTICAL INVENTORY RECONCILIATION TEST METHOD

Certification: Method is certified to detect a 0.1 gph leak rate with $P_D = 99.5\%$ and $P_{FA} = < 0.5\%$.

Leak Threshold: A leak is declared when leak rate exceeds 0.05 gallon per hour.

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4.

Tank Capacity: Maximum single tank capacity shall not exceed 21,000 gallons. Maximum total capacity for tanks in a manifolded system shall not exceed 60,000 gallons.

Data Requirement: Minimum of 30 days of product level and flow through data.

Comments: 32% of the data sets used in this evaluation were from manifolded tanks. 89% of the manifolded tanks had manually stuck data.

A maximum of three tanks were included in the manifolded systems used in this evaluation. The largest single tank capacity was 20,000 gallons.

Of the 56 data sets presented for evaluation, 6 were not analyzed due to unusable data. There were no inconclusives.

The median monthly throughput of tanks used in this evaluation was 52,207 gallons.

Leak rates ranging from 0.0497 to 0.2003 were used in the evaluation.

Data sets used in this evaluation were supplied by the evaluator.

Entropy Limited
South Great Rd.
Lincoln, MA 01773
Tel: (617) 256-8901

Evaluator: Simpson, Gumpertz & Heger, Inc.

Date of Evaluation: 11/30/93

EASI Level-Tru

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.2 gallon per hour with $P_D = 95.4\%$ & $P_{FA} = 4.6\%$.

Leak Threshold: 0.1 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4, antifreeze, brake fluid, transmission fluid, and solvents.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be at least 50% full.

Waiting Time: Minimum waiting time between product delivery to the tank and test data collection must be 4.1 hours.

Test Period: The minimum data collection time must be 3.6 hours.
Test data must be acquired and recorded by a computer.
Leak rate is calculated from data collected over the entire range of the test period.
There must be no dispensing or product delivery during the test.

Temperature: A minimum of 5 resistance temperature detectors must be used to determine the average temperature of the stored substance.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 0.896 inches.
Minimum detectable change in water level is 0.023 inches.

Calibration: Temperature sensors and probe must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment only tests the portion of the tank that contains product.
As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).
System is currently undergoing 3rd party certification for 0.1 gph leak rate.

Environment and Safety, Inc.
2075 O'Toole Avenue
San Jose, CA 95131
Tel: (408) 954-9081

Evaluator: Midwest Research Institute

Date of Evaluation: 04-11-91

DRAFT

Environmental Fuel Systems, Inc.

Fuel Finder
Version IV

VAPOR PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: quantitative
 Sampling frequency: intermittent
 Operating principle: adsorption sampling

Test Results:

	<u>Benzene</u>	<u>2-Methylbutane</u>
Accuracy (%) [Avg. Reading]:	106.8 [1647 ppm]	122.7 [1380 ppm]
Bias (%)	64.5	38.2
Precision (%)	22.3	53.2
Detection Time (min:sec):	Not App.	Not App.
Fall Time (min:sec):	Not App.	Not App.
Lower Detection Limit (ppm):	77	116

Specificity Results:

	<u>%</u>
Benzene	147.7
n-Butane	90.7
n-Hexane	55.7
Isobutane	51.1
2-Methylpentane	143.7
Toluene	66.5

Manufacturer's Specifications:

Comments:

Environmental Fuel Systems, Inc.
 P.O. Box 1889
 Bandera, TX 78003
 Tel: (800) 375-7747

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 04-20-93

DRAFT

Environmental Management Technologies

SIRTECH (quantitative)

STATISTICAL INVENTORY RECONCILIATION TEST METHOD

Certification:

Method is certified to detect a 0.1 gph leak rate with a $P_D = 99\%$ and $P_{FA} = 1\%$.

Leak Threshold:

A leak is declared when leak rate exceeds 0.05 gph.

Applicability:

Gasoline, diesel, aviation fuel, and fuel oil #4.

Tank Capacity:

Maximum tank capacity shall not exceed 18,000 gallons.

Data Requirement:

Minimum 30 days of usable product level and flow through data are required.

Comments:

Of the 41 data sets presented for evaluation, 5 were inconclusive.

The median monthly throughput for tanks used in this evaluation was 14,600 gallons.

Leak rates of 0.05, 0.1, and 0.2 gph were used in this evaluation.

Data Sets used in this evaluation were supplied by the vendor.

This evaluation did not include data from manifolded tanks.

Environmental Management Technologies
 20001 Glen Echo Rd.
 Nashville, TN 37215
 (615) 385-5503

Evaluator: Nathan Adams, Middle TN State Univ.

Date of Evaluation: 11-05-92

Enviro Tite SIR (also known as SIRAS 99.6) (quantitative)

STATISTICAL INVENTORY RECONCILIATION TEST METHOD

Certification: Method is certified to detect a 0.1 gph leak rate with a $P_D = 99.6\%$ and $P_{FA} = 0.4\%$.

Leak Threshold: A leak is declared when leak rate exceeds 0.05 gph.

Applicability: Gasoline, diesel, aviation fuel, and fuel oil #4.

Tank Capacity: Maximum UST capacity shall not exceed 18,000 gallons.

Data Requirement: Minimum of 31 days to make an SIR evaluation with at least 95% confidence at the rate of 0.1 gph, and vendor recommends 45 to 60 days for greater confidence.

Comments: Of the 41 data sets presented for evaluation, 5 were not analyzed due to unusable data.

The median monthly throughput for tanks used in this evaluation was 16,700 gallons.

Leak rates ranging from 0.0500 to 0.2043 were used in the evaluation.

Data Sets used in this evaluation were supplied by the evaluator.

This evaluation did not include data from manifolded tanks.

EnviroQuest Technologies Limited
4501 Madison
Kansas City, MO 64111
Tel: (800) 756-0774

Evaluator: Midwest Research Institute

Date of Evaluation: 04-03-92

SIRAS Software System, Version 2.0 (quantitative)

STATISTICAL INVENTORY RECONCILIATION TEST METHOD

Certification: Version 2.0 is designed to meet annual tests requirements. Method certified to detect a 0.1 gph leak rate with a $P_D = 99.3\%$ and $P_{FA} = 0.7\%$.

Leak Threshold: A leak is declared when the calculated leak rate exceed the threshold of 0.05 gph.

Applicability: Gasoline, diesel, aviation fuel, and fuel oil #4.

Tank Capacity: Maximum single tank capacity shall not 30,000 gallons. Maximum total capacity for tanks in a manifolded system shall not exceed 60,000 gallons.

Data Requirement: Minimum 30 days of usable product level and flowthrough data are required.

Comments: 27% of the data sets used in this evaluation were from manifolded tanks.

A maximum of 4 tanks were included in the manifolded systems used in the evaluation. The largest individual tank in this evaluation was 30,000 gallons. Of the 56 data sets presented for evaluation 6 were not analyzed due to unusable data.

The median monthly throughput for tanks used in this evaluation was 73,518 gallons.

Leak rates ranging from 0.0458 to 0.2500 gph were used in the evaluation. Data sets used in this evaluation were supplied by the evaluator.

Over 50% of the data from large manifolded tanks was collected by automatic tank gauges.

EnviroQuest Technologies Limited
4501 Madison
Kansas City, MO 64111
Tel: (816) 756-0774

Evaluator: Midwest Research Institute

Date of Evaluation: 08-23-93

STATISTICAL INVENTORY RECONCILIATION TEST METHOD

Certification: Version 2.8.3 is designed to meet monthly monitoring requirements. Method certified to detect a 0.2 gph leak rate with a $P_D = 99.999\%$ and $P_{FA} = 0.01\%$.

Leak Threshold: A leak is declared when the calculated leak rate exceeds the threshold of 0.10 gph.

Applicability: Gasoline, diesel, aviation fuel, and fuel oil #4.

Tank Capacity: Maximum single tank capacity shall not exceed 30,000 gallons. Maximum total capacity for tanks in a manifolded system shall not exceed 60,000 gallons.

Data Requirement: Minimum 30 days of usable product level and flowthrough data are required.

Comments: 27% of the data sets used in this evaluation were from manifolded tanks.

A maximum of 4 tanks were included in the manifolded systems used in the evaluation. The largest individual tank in this evaluation was 30,000 gallons. Of the 56 data sets presented for evaluation 6 were not analyzed due to unusable data. The median monthly throughput for tanks used in this evaluation was 73,518 gallons. Leak rates ranging from 0.0458 to 0.2500 gph were used in the evaluation. Data sets used in this evaluation were supplied by the evaluator. Over 50% of the data from large manifolded tanks was collected by automatic tank gauges.

EnviroQuest Technologies Limited
4501 Madison
Kansas City, MO 64111
Tel: (816) 756-0774

Evaluator: Midwest Research Institute

Date of Evaluation: 08-23-93

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: fiber optic chemical sensor

Test Results:

	Commercial Gasoline	Synthetic Gasoline
Accuracy(%)	100	100
Detection time (min)	<8	<8
Fall Time (min)	<5	<5
Lower detection limit (cm)	<0.01	<0.01

Specificity Results:

Activated: commercial gasoline, n-Hexane, diesel fuel, Jet-A fuel, toluene, synthetic gasoline, xylene(s).

Manufacturer's Specifications:**Comments:**

EPA and many states require detection of 1/8 inch of product, which is 0.32 cm. The detector is reusable.

FCI Environmental, Inc.
1181 Grier Drive, Bldg. B
Las Vegas, NV 89119
Tel: (800) 510-3627

Evaluator: Ken Wilcox Associates

Date of Evaluation: 01-15-94

DRAFT

FCI Environmental, Inc.

Digital Hydrocarbon Probe DHP-100

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
 Sampling frequency: continuous
 Operating principle: fiber optic chemical sensor

Test Results:

	Commercial Gasoline	Synthetic Gasoline
Accuracy(%)	100	100
Detection time (min)	<8	<8
Fall Time (min)	<5	<5
Lower detection limit (cm)	<0.01	<0.01

Specificity Results:

Activated: commercial gasoline, n-Hexane, diesel fuel, Jet-A fuel, toluene, synthetic gasoline, xylene(s).

Manufacturer's Specifications:

Comments:

EPA and many states require detection of 1/8 inch of product, which is 0.32 cm. The detector is reusable.

FCI Environmental, Inc.
 1181 Grier Drive, Bldg. B
 Las Vegas, NV 89119
 Tel: (800) 510-3627

Evaluator: Ken Wilcox Associates

Date of Evaluation: 01-15-94

DRAFT

FCI Environmental, Inc.

Analog Hydrocarbon Probe AHP-100

VAPOR PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: quantitative
 Sampling frequency: continuous
 Operating principle: fiber optic

Test Results:

	EPA March 1990 protocol			Radian June 1990 protocol	
	Xylene	Benzene	2-Methylbutane	Unl. Gasoline	Synth.
Gasoline					
Relative Accuracy* (%)	2	35	NR**	12	22
Bias (%)	1	-23	NR	-7	-2
Precision (%)	1	11	NR	4	15
Detection Time (min)	<1	<1	NR	<1	<1
Fall Time (min)	<1	<1	NR	<1	<1
Lower Detect. Limit (ppm)	84	519	NR	137	220

* Relative accuracy is a function of systematic error, or bias, and random error, or precision. Smaller values indicate better accuracy.

** No Response

Specificity Results (%) (corrected for sensitivity differences):

	EPA March 1990 protocol	Radian June 1990 protocol
Benzene	76	Unleaded Gasoline 93
Toluene	96	Synthetic Gasoline 98
p-Xylene	101	JP-4 Jet Fuel 105
Synthetic Gasoline	100	n-Hexane NR
Trimethylbenzene	107	Xylene 103
Methane	NR	
Butane	NR	
2-Methylbutane	NR	
Pentane	NR	

Manufacturer's Specifications:

Comments:

The test procedures used were taken from EPA's "Standard Test Procedures for Evaluation Leak Detection Methods: Vapor-Phase Out-of-Tank Product Detectors," March 1990, and Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods," June 6, 1990.

FCI Environmental, Inc.
 1181 Grier Drive, Bldg. B
 Las Vegas, NV 89119
 Tel: (800) 510-3627

Evaluator: Ken Wilcox Associates

Date of Evaluation: 03-07-94

DRAFT

FCI Environmental, Inc.

Digital Hydrocarbon Probe DHP-100

VAPOR PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: quantitative
 Sampling frequency: continuous
 Operating principle: fiber optic

	EPA March 1990 protocol			Radian June 1990 protocol	
	Xylene	Benzene	2-Methylbutane	Unl. Gasoline	Synth.
Gasoline					
Relative Accuracy* (%):	0	17	NR**	18	29
Bias (%):	0	-9	NR	1	-12
Precision (%):	0	11	NR	9	10
Detection Time (min):	<1	<1	NR	<1	<1
Fall Time (min):	<1	<1	NR	<1	<1
Lower Detect. Limit (ppm):	45	280	NR	73	118

* Relative accuracy is a function of systematic error, or bias, and random error, or precision. Smaller values indicate better accuracy.

** No Response

Specificity Results (%) (corrected for sensitivity differences):

EPA March 1990 protocol		Radian June 1990 protocol	
Benzene	89	Unleaded Gasoline	101
Toluene	97	Synthetic Gasoline	88
p-Xylene	100	JP-4 Jet Fuel	109
Synthetic Gasoline	92	n-Hexane	108
Trimethylbenzene	104	Xylene	NR
Methane	NR		
Butane	NR		
2-Methylbutane	NR		
Pentane	NR		

Manufacturer's Specifications:

Comments:

The test procedures used were taken from EPA's "Standard Test Procedures for Evaluation Leak Detection Methods: Vapor-Phase Out-of-Tank Product Detectors," March 1990, and Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods," June 6, 1990.

FCI Environmental, Inc.
 1181 Grier Drive, Bldg. B
 Las Vegas, NV 89119
 Tel: (800) 510-3827

Evaluator: Ken Wilcox Associates

Date of Evaluation: 03-07-94

DRAFT

FE Petro, Inc.

STP-MLD Pipeline Leak Detector

MECHANICAL LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gallons per hour with $P_D = 100\%$ & $P_{FA} = 0\%$;

Leak Threshold: 2.0 gallons per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4, and solvents.

Specification: System can test fiberglass and steel pipelines.
 The piping system volume must not exceed 129.14 gallons.
 Tests are conducted at the line operating pressure.

Waiting Time: No waiting time between last delivery of the product to the tank and the start of data collection.
 No waiting time between last dispensing of product through the pipeline and the start of data collection for the test.

Test Period: Data collection time for the test is less than 30 seconds.

System Features: This system is permanently installed on the piping and automatically tests the line.
 It uses a preset threshold and a single test to determine whether the piping is leaking.
 If a leak is detected, this system restricts fuel flow to dispenser.

Calibration: Equipment must be checked annually in accordance with manufacturer's instructions.

FE Petro, Inc.
 P.O. Box 139
 McFarland, WI 53558
 Tel: (808) 838-8786

Evaluator: Ken Wilcox Associates

Date of Evaluation: 07-01-92

FE Petro, Inc.

STP-MLD-D Pipeline Leak Detector

MECHANICAL LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gallons per hour with $P_D = 100\%$ & $P_{FA} = 0\%$;

Leak Threshold: 2.0 gallons per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Diesel.

Specification: System is installed on steel and fiberglass (rigid) lines.
The piping system (rigid) volume must not exceed 341 gallons.
Tests are conducted at the line operating pressure.

Waiting Time: No waiting time between last delivery of the product to the tank and the start of data collection.
No waiting time between last dispensing of product through the pipeline and the start of data collection for the test.

Test Period: Average data collection time is 1 minute.

System Features: This system is permanently installed on the piping and automatically tests the line.
It uses a preset threshold and a single test to determine whether the piping is leaking.
If a leak is detected, this system restricts fuel flow to dispenser.

Calibration: Equipment must be checked annually for capability of detecting a leak of 3.0 gallons per hour.

FE Petro, Inc.
P.O. Box 139
McFarland, WI 53558
Tel: (608) 838-8786

Evaluator: Ken Wilcox Associate

Date of Evaluation: 04-30-94

FE Petro, Inc.

STP-MLD-E Line (Flexline) Leak Detector

MECHANICAL LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gallons per hour with $P_D = 100\%$ & $P_{FA} = 0\%$;

Leak Threshold: 2.0 gallons per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, and some solvents.

Specification: System is installed on flexible line.
The piping system volume must not exceed 49.6 gallons.
Tests are conducted at the line operating pressure.

Waiting Time: No waiting time between last delivery of the product to the tank and the start of data collection.
No waiting time between last dispensing of product through the pipeline and the start of data collection for the test.

Test Period: Average data collection time is 3 minutes.

System Features: This system is permanently installed on the piping and automatically tests the line.
It uses a preset threshold and a single test to determine whether the piping is leaking.
If a leak is detected, this system restricts fuel flow to dispenser.

Calibration: Equipment must be checked annually for capability of detecting a leak of 3.0 gallons per hour.

Comments: Enviroflex line with a bulk modulus of 1,280 was used during the third-party evaluation.

FE Petro, Inc.
P.O. Box 139
McFarland, WI 53558
Tel: (608) 838-8786

Evaluator: Ken Wilcox Associate

Date of Evaluation: 03-24-94

Gasboy International

Gasboy TMS 500

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.2 gallon per hour with $P_D = 99.91\%$ & $P_{FA} = 0.09\%$.

Leak Threshold: 0.1 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, and solvents.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be between 50 and 95% full.

Waiting Time: Minimum waiting time between product delivery to the tank and test data collection must be 6 hours.

Test Period: The minimum data collection time must be 3 hours.
Test data must be acquired and recorded by a computer.
There must be no dispensing or product delivery during the test.

Temperature: A minimum of five temperature sensors must be used to determine the average temperature of the stored substance.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 1.04 inches.
Minimum change in water level that can be detected is 0.011 inches.

Calibration: Temperature sensors and probes must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment only tests that portion of the tank which contains product.
As the product level is lowered, the leak rate in a leaking tank decreases (due to lower head pressure).
This system is no longer being manufactured although product support is still available.
Gasboy International was formerly called William M. Wilson's Sons.

Gasboy International
P.O. Box 309
Lansdale, PA 19446
Tel: (215) 855-4631

Evaluator: Ken Wilcox Associates

Date of Evaluation: 05-10-91

Gilbarco Environmental Products

EMC Environmental Management Console, EMC Basic Monitoring System
Tank Monitor 2, 3, 2.1, and 3.1, PA0238000XXXX Capacitance Probe

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.2 gallon per hour with $P_D = 99\%$ & $P_{FA} = 1\%$.

Leak Threshold: 0.1 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, and solvents.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be between 50 and 95% full.

Waiting Time: Minimum waiting time between delivery to the tank and test data collection must be 8.3 hours.

Test Period: The minimum data collection time must be 5 hours.
Test data must be acquired and recorded by a microprocessor within the monitoring console.
Leak rate is calculated from converting the level signals from the probe during the test period to temperature-compensated volume change.
There must be no dispensing or product delivery during the test.

Temperature: A temperature averaging probe (thermistor) must be used to determine the average temperature of the stored hazardous substance.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 1.40 inches.
Minimum detectable water level change is 0.040 inches.

Calibration: The in-tank probe with temperature and water sensor is self-calibrating but occasional system checks may be required in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment only tests the portion of the tank that contains product.
As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).

Gilbarco Environmental Products
7300 W. Friendly Avenue
Greensboro, NC 27420
Tel: (910) 547-5000

Evaluator: Midwest Research Institute

Date of Evaluation: 05-14-93

DRAFT

Gilbarco Environmental Products

EMC Environmental Management Console, EMC Basic Monitoring System
Tank Monitor 2.1, 3.1, PA0264XXX0000 Capacitance Probe

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.2 gallon per hour with $P_D=99\%$ & $P_{FA}=0.2\%$.

Leak Threshold: 0.126 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, and solvents.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be between 50 and 95% full.

Waiting Time: Minimum waiting time between delivery to the tank and test data collection must be 8.3 hours.

Test Period: The minimum data collection time must be 2 hours.
Test data must be acquired and recorded by a microprocessor within the monitoring console.
Leak rate is calculated from converting the level signals from the probe during the test period to temperature-compensated volume change.
There must be no dispensing or product delivery during the test.

Temperature: A minimum of 5 thermistors must be used to determine the average temperature of the stored hazardous substance.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 1.52 inches.
Minimum change in water level that can be detected is 0.027 inches.

Calibration: The in-tank probe with temperature and water sensors is self-calibrating but occasional checks may be required in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment only tests the portion of the tank that contains product.
As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).

Gilbarco Environmental Products
7300 W. Friendly Avenue
Greensboro, NC 27420
Tel: (910) 547-5000

Evaluator: Midwest Research Institute

Date of Evaluation: 05-14-93

DRAFT

Gilbarco Environmental Products

EMC Environmental Management Console, EMC Basic Monitoring System
Tank Monitor 2.1, 3.1, PA0264XXX0000 Capacitance Probe

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.1 gallon per hour with $P_D=99\%$ & $P_{FA}=0.1\%$.

Leak Threshold: 0.071 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, and solvents.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be at least 95% full.

Waiting Time: Minimum waiting time between delivery to the tank and test data collection must be 8.25 hours.

Test Period: The minimum data collection time must be 3 hours.
Test data must be acquired and recorded by a microprocessor within the monitoring console.
Leak rate is calculated from converting the level signals from the probe during the test period to temperature-compensated volume change.
There must be no dispensing or product delivery during the test.

Temperature: A minimum of 5 thermistors must be used to determine the average temperature of the stored substance.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 1.52 inches.
Minimum detectable water level change is 0.027 inches.

Calibration: The in-tank probe with temperature and water sensor is self-calibrating but occasional checks may be required in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment only tests the portion of the tank that contains product.
As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).

Gilbarco Environmental Products
7300 W. Friendly Avenue
Greensboro, NC 27420
Tel: (910) 547-5000

Evaluator: Midwest Research Institute

Date of Evaluation: 05-14-93

EMC Environmental Management Console, EMC Basic Monitoring System
Tank Monitor 2.1, 3.1, PA0265XXX0000 Magnetostrictive Probe

AUTOMATIC TANK GAUGING SYSTEM

Certification:	Leak rate of 0.2 gallon per hour with $P_D=99\%$ & $P_{FA}=0.1\%$.
Leak Threshold:	0.093 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
Applicability:	Gasoline, diesel, aviation fuel, and solvents.
Capacity:	The maximum tank capacity is 15,000 gallons. The tank must be between 50 and 95% full.
Waiting Time:	Minimum waiting time between delivery to the tank and test data collection must be 8.3 hours.
Test Period:	The minimum data collection time must be 2 hours. Test data must be acquired and recorded by a microprocessor within the monitoring console. Leak rate is calculated from converting the level signals from the probe during the test period to temperature-compensated volume change. There must be no dispensing or product delivery during the test.
Temperature:	A minimum of 5 thermistors are used to determine the average temperature of the stored hazardous substance.
Water Sensor:	A water sensor must be used to detect water incursion. Minimum water level detectable in the tank is 0.544 inches. Minimum change in water level that can be detected is 0.027 inches.
Calibration:	The in-tank probe with temperature and water sensor is self-calibrating but occasional checks may be required in accordance with manufacturer's instructions.
Comments:	This equipment was not evaluated using manifolded tanks. This equipment only tests the portion of the tank that contains product. As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).

Gilbarco Environmental Products
7300 W. Friendly Avenue
Greensboro, NC 27420
Tel: (910) 547-5000

Evaluator: Midwest Research Institute

Date of Evaluation: 05-14-93

EMC Environmental Management Console, EMC Basic Monitoring System
Tank Monitor 2.1, 3.1, PA0265XXX0000 Magnetostrictive Probe

AUTOMATIC TANK GAUGING SYSTEM

Certification:	Leak rate of 0.1 gallon per hour with $P_D=99\%$ & $P_{FA}=1\%$.
Leak Threshold:	0.069 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
Applicability:	Gasoline, diesel, aviation fuel, and solvents.
Capacity:	The maximum tank capacity is 15,000 gallons. The tank must be at least 95% full.
Waiting Time:	Minimum waiting time between product delivery to the tank and test data collection must be 8.25 hours.
Test Period:	The minimum data collection time must be 3 hours. Test data must be acquired and recorded by a microprocessor within the monitoring console. Leak rate is calculated from converting the level signals from the probe during the test period to temperature-compensated volume change. There must be no dispensing or product delivery during the test.
Temperature:	A minimum of 5 thermistors are used to determine the average temperature of the stored substance.
Water Sensor:	A water sensor must be used to detect water incursion. Minimum water level detectable in the tank is 0.544 inches. Minimum change in water level that can be detected is 0.027 inches.
Calibration:	The in-tank probe with temperature and water sensor is self-calibrating but occasional checks may be required in accordance with manufacturer's instructions.
Comments:	This equipment was not evaluated using manifolded tanks. This equipment only tests the portion of the tank that contains product. As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).

Gilbarco Environmental Products
7300 W. Friendly Avenue
Greensboro, NC 27420
Tel: (910) 547-5000

Evaluator: Midwest Research Institute

Date of Evaluation: 05-14-93

DRAFT

Gilbarco Environmental Products

Environmental Management Console (EMC)
Groundwater Sensor, series PA02700XX0001

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: electrical conductivity

Test Results:

	Commercial Gasoline	Synthetic Gasoline
Accuracy(%)	100	100
Detection time(min:sec)	08:55	06:18
Fall Time (min:sec)	54:50	26:02
Lower detection limit(cm)	0.02	0.02

Specificity Results:

Activated: commercial gasoline, n-Hexane, diesel fuel, Jet-A fuel, toluene, synthetic gasoline, xylene(s).

Calibration: Sensor must be checked annually for operability or in accordance with manufacturer's instructions and calibrated/replaced if necessary.

Comments: EPA and many states require detection of 1/8 inch of product, which is 0.32 cm. This detector is reusable.

Gilbarco Environmental Products
7300 W. Friendly Ave.,
Greensboro, NC 27420
(910) 547-5000

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 11-20-91

DRAFT

Gilbarco Environmental Products

PA02590XXX000

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: float switch

Test Results*:

	Commercial Gasoline**	Commercial Gasoline***
Accuracy (%)	100	100
Response time (min)	3.66	3.45
Recovery time (min)	<1	<1
Product activation height (cm)	1.28	1.27
Lower Detection Limit (cm)	1.84	1.65

* at a flow rate of 0.19 gal/hr in 7.6 cm diameter test chamber

Specificity Results:

Activated: diesel fuel, synthetic fuel, home heating oil #2, water

Manufacturer's Specifications:

Comments: Evaluation performed on equivalent Veeder-Root detector. EPA and many states require detection of 1/8 inch of product, which is 0.32 cm, for ground water monitoring. The test procedures used were those in Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.

** evaluated for Veeder-Root TLS-250, TLS 250i Plus, ILS 250

*** evaluated for Veeder-Root ILS 350, TLS-350

Gilbarco Environmental Products
7300 W. Friendly Ave.
Greensboro, NC 27420
Tel: (910) 547-5000

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 07-17-92

DRAFT

Gilbarco Environmental Products

PA02591144000

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
 Sampling frequency: continuous
 Operating principle: float switch

Test Results:

	Commercial Gasoline*	Commercial Gasoline**
Accuracy (%)	100	100
Response time (min)	6.00	6.51
Recovery time (min)	<1	<1
Product activation height (cm)	3.67	3.62
Lower Detection Limit (cm)	4.05	4.17

Specificity Results:

Activated: diesel fuel, synthetic fuel, home heating oil #2, water

Manufacturer's Specifications:

Comments: Evaluation performed on equivalent Veeder-Root detector. EPA and many states require detection of 1/8 inch of product, which is 0.32 cm, for ground water monitoring. The test procedures used were those in Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.

- * evaluated for Veeder-Root TLS-250, TLS 250i Plus, ILS 250, at a flow rate of 0.13 gal/hr in 4.8 cm diameter test chamber
- ** evaluated for Veeder-Root ILS 350, TLS-350, at a flow rate of 0.12 gal/hr in 4.8 cm diameter test chamber

Gilbarco Environmental Products
 7300 W. Friendly Ave.
 Greensboro, NC 27420
 Tel: (910) 547-5000

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 07-17-92

DRAFT

Gilbarco Environmental Products

PA02592000000

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
 Sampling frequency: continuous
 Operating principle: float switch

Test Results:

	Commercial Gasoline*	Commercial Gasoline**
Accuracy (%)	100	100
Response time (min)	8.19	8.49
Recovery time (min)	<1	<1
Product activation height (cm)	4.12	3.95
Lower Detection Limit (cm)	4.67	4.36

Specificity Results:

Activated: diesel fuel, synthetic fuel, home heating oil #2, water

Manufacturer's Specifications:

Comments: Evaluation performed on equivalent Veeder-Root detector. EPA and many states require detection of 1/8 inch of product, which is 0.32 cm, for ground water monitoring. The test procedures used were those in Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.

- * evaluated for Veeder-Root TLS-250, TLS 250i Plus, ILS 250, at a flow rate of 0.15 gal/hr in 5.8 cm diameter test chamber
- ** evaluated for Veeder-Root ILS 350, TLS-350, at a flow rate of 0.14 gal/hr in 5.8 cm diameter test chamber

Gilbarco Environmental Products
 7300 W. Friendly Ave.
 Greensboro, NC 27420
 Tel: (910) 547-5000

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 07-17-92

DRAFT

PA02660000000

VAPOR PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
 Sampling frequency: continuous
 Operating principle: adsistor

Test Results:

	Commercial Gasoline	Synthetic Gasoline	JP-4
Accuracy (%):	100	0	100
Detection Time (min:sec):	7:46	Not App.	17:01
Fall Time (min:sec):	2:38	Not App.	3:05
Lower Detection Limit (ppm):	500	>1000	500

Specificity Results (%):

Activated: Commercial gasoline, JP-4 jet fuel
 No response: n-Hexane, Synthetic gasoline, Toluene, Xylene(s)

Manufacturer's Specifications:

Comments: Evaluation performed on equivalent Veeder-Root detector. The test procedures used were those in Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods," June 29, 1990.

Gilbarco Environmental Products
 7300 W. Friendly Ave.
 Greensboro, NC 27420
 Tel: (910) 547-5000

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 07-24-92

DRAFT

Environmental Management Console (EMC)
 with Line Leak Detector, Series PA02630000501

ELECTRONIC LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gallon per hour with $P_0 = 100\%$ & $P_{FA} = 0\%$.

Leak Threshold: 1.5 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, and solvent.

Specification: System is installed on pressurized fiberglass and steel piping. The piping system volume must not exceed 41 gallons. Tests are conducted at the line operating pressure.

System is installed on pressurized flexible piping. The piping volume must not exceed 158.4 gallons. Tests are conducted at the line pressure. The mechanical line leak detector must be removed from the pipeline.

Waiting Time: There is no waiting time between product delivery of the product to the tank and the start of data collection. Minimum waiting period between last dispensing and testing depends on volume of product and temperature gradient which is determined by the system's computer.

Test Period: The minimum data collection time (response time) for the test must be 12 minutes. Test data must be acquired and recorded by a microprocessor. Calculations are automatically done by the microprocessor.

Calibration: Sensor must be checked and calibrated annually in accordance with manufacturer's instructions.

System Features: This system is permanently installed on the piping and automatically tests the line. It uses a preset threshold and a single test to determine whether the piping is leaking. If a leak is declared, this system displays a message, triggers an alarm, and shuts down the dispensing system.

Gilbarco Environmental Products
 7300 W. Friendly Ave.,
 Greensboro, NC 27420
 (910) 547-5000

Evaluator: Ken Wilcox Associates, Inc.

Date of Evaluation: 4/12/93

Gilbarco Environmental Products

Environmental Management Console (EMC)
with Line Leak Detector, Series PA02630000501

ELECTRONIC LINE LEAK DETECTOR

- Certification:** Leak rate of 0.2 gallon per hour with $P_0 = 100\%$ & $P_{FA} = 0\%$.
- Leak Threshold:** 0.10 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
- Applicability:** Gasoline, diesel, aviation fuel, and solvent.
- Specification:** System is installed on pressurized fiberglass and steel piping. The piping system volume must not exceed 41 gallons. Tests are conducted at the line operating pressure.
- System is installed on pressurized flexible piping. The piping volume must not exceed 158.4 gallons. Tests are conducted at the line pressure. The mechanical line leak detector must be removed from the pipeline.
- Waiting Time:** There is no waiting time between product delivery of the product to the tank and the start of data collection. Minimum waiting period between last dispensing and testing depends on volume of product and temperature gradient which is determined by the system's computer.
- Test Period:** The minimum data collection time (response time) for the test must be 0.75 to 8.85 hours. Test data must be acquired and recorded by a microprocessor. Calculations are automatically done by the microprocessor.
- Calibration:** Sensor must be checked and calibrated annually in accordance with manufacturer's instructions.
- System Features:** This system is permanently-installed on the piping and automatically tests the line. It uses a preset threshold and a single test to determine whether the piping is leaking. If a leak is declared, this system displays a message, triggers an alarm, and shuts down the dispensing system.

Gilbarco Environmental Products
7300 W. Friendly Ave.,
Greensboro, NC 27420
(910) 547-5000

Evaluator: Ken Wilcox Associates, Inc.

Date of Evaluation: 4/12/93

Gilbarco Environmental Products

Environmental Management Console (EMC)
with Line Leak Detector, Series PA02630000501

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

- Certification:** Leak rate of 0.1 gallon per hour with $P_0 = 100.0\%$ & $P_{FA} = 0\%$.
- Leak Threshold:** 0.079 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
- Applicability:** Gasoline, diesel, aviation fuel, and solvent.
- Specification:** System is installed on pressurized fiberglass and steel piping. The piping system volume must not exceed 41 gallons. Tests are conducted at the line operating pressure. System is installed on pressurized flexible piping. The piping volume must not exceed 158.4 gallons. Tests are conducted at the line pressure. The mechanical line leak detector must be removed from the pipeline.
- Waiting Time:** There is no waiting time between product delivery and testing. Minimum waiting period between last dispensing and testing depends on volume of product and temperature gradient which is determined by the system's computer.
- Test Period:** Minimum data collection time must be 1.2 to 12.9 hours. Test data must be acquired and recorded by a microprocessor. Calculations are automatically done by the microprocessor.
- Calibration:** Sensor must be checked and calibrated annually in accordance with manufacturer's instructions.
- System Features:** This system is permanently installed on the piping and automatically tests the line. It uses a preset threshold and a single test to determine whether the piping is leaking. If a leak is declared, this system displays a message, triggers an alarm, and shuts down the dispensing system.

Gilbarco Environmental Products
7300 W. Friendly Ave.
Greensboro, NC 27420
(910) 547-5000

Evaluator: Ken Wilcox Associates, Inc.

Date of Evaluation: 08-04-93

Leak Computer Tank Test System (Overfilled Test)

VOLUMETRIC TANK TIGHTNESS TEST METHOD (EDISON LAB PROTOCOL)

- Certification:** Leak rate of 0.1 gallon per hour with $P_D = 95\%$ & $P_{FA} = 5.0\%$.
- Leak Threshold:** 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, fuel oil #6, solvents, waste oil, and other liquids compatible with the probes.
- Capacity:** The maximum tank capacity is 12,000 gallons.
The tank must be at least 100% full.
- Waiting Time:** The test data must be acquired and recorded by a computer that calculates a leak rate every minute, and determines waiting time for satisfactory data (the test is finished when the standard deviation of 30 sequential leak rates is less than half of the last leak rate determined).
There must be no dispensing or product delivery during the test waiting time.
- Test Period:** The minimum data collection time must be 70 minutes.
Leak rate is calculated from data determined to be valid by statistical analysis.
- Temperature:** A minimum of 7 temperature sensors (thermistors) must be used to determine the average temperature of the stored product.
- Ground Water:** If the groundwater level is not determined, the tank must pass a two level test with at least a 3 foot difference in product level. If the groundwater level can be determined, a single level test can be conducted provided a net pressure difference of at least 1 psi exists between the groundwater and product at the bottom of the tank.
- Calibration:** Level sensor must be calibrated before each test.
Temperature sensors must be calibrated annually.
- Comments:** This equipment was evaluated at the EPA Edison Risk Reduction Engineering Laboratory prior to the standard protocols being written.
This equipment was not evaluated using manifolded tanks.

Hasstech
6985 Flanders Dr.
San Diego, CA 92121
Tel: (619) 457-5880

Evaluator: U.S. EPA Risk Reduction Engineering Laboratory

Date of Evaluation: 11/88

Leak Computer Tank Test System (Underfilled Test)

VOLUMETRIC TANK TIGHTNESS TEST METHOD

- Certification:** Leak rate of 0.1 gallon per hour with $P_D > 99\%$ & $P_{FA} < 1\%$.
- Leak Threshold:** 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, fuel oil #6, solvents, waste oil, and other liquids compatible with the probes.
- Capacity:** The maximum tank capacity is 15,000 gallons.
The tank must be at least 90% full.
- Waiting Time:** The test data must be acquired and recorded by a computer that calculates a leak rate every minute, and determines waiting time for satisfactory data (the test is finished when the standard deviation of 30 sequential leak rates is less than half of the last leak rate determined).
There must be no dispensing or product delivery during the test waiting time.
- Test Period:** The minimum data collection time must be 70 minutes.
Leak rate is calculated from data determined to be valid by statistical analysis.
- Temperature:** A minimum of 7 temperature sensors (thermistors) must be used to determine the average temperature of the stored product.
- Ground Water:** Depth to the water table in the backfill must be determined and, if it is above the bottom of the tank, product level must be raised to provide minimum of 1 psi net pressure on the bottom of the tank.
- Calibration:** Level sensor must be calibrated before each test.
Temperature sensors must be calibrated annually.
- Comments:** This equipment was not evaluated using manifolded tanks.
This equipment only tests the portion of the tank that contains product.

Hasstech
6985 Flanders Dr.
San Diego, CA 92121
Tel: (619) 457-5880

Evaluator: Law Engineering Industrial Services

Date of Evaluation: 04/17/91

Hasstech

AcuRite

LINE TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gallon per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.

Leak Threshold: 0.01 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, and fuel oil #4.

Specification: System tests fiberglass and steel piping.
The piping system volume must not exceed 75 gallons.
Tests are conducted at 150% of the line operating pressure.
The mechanical line leak detector must be removed from the piping system being tested.

Waiting Time: Minimum waiting period between product delivery and testing is 6 hours.
Minimum waiting period between last dispensing and testing is 30 minutes.

Test Period: The minimum data collection time must be 30 minutes.
Test data must be acquired and recorded manually.
Manual calculations are performed by the tester on site.

Calibration: Equipment must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Hasstech
6985 Flanders Dr.
San Diego, CA 92121
Tel: (619) 457-5880

Evaluator: Lamar University

Date of Evaluation: 03/25/91

Hasstech

LineTite Pipeline Leak Monitor

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gallon per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.

Leak Threshold: 2.00 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, and aviation fuel.

Specification: System can be installed on pressurized fiberglass, steel, and flexible piping.
The rigid piping system volume must not exceed 341 gallons.
The flexible piping system volume must not exceed 49.6 gallons.
Tests are conducted at the line operating pressure.

Waiting Time: There is no waiting period between product delivery and testing.
There is no waiting period between last dispensing and testing.

Test Period: Minimum data collection time (response time) is 1 minute.
Minimum data collection time is 1 minute; this is a single test consisting of multiple cycles of data acquisition with 1-24 minutes waiting time between each cycle.
Test data must be acquired and recorded by a permanently installed microprocessor.
Calculations are automatically done by the microprocessor.

System Features: This system is permanently installed on the pipeline and automatically tests the line.
Uses a preset threshold and a single test to determine whether the pipeline is leaking.
If a leak is declared, this system displays a message, triggers an alarm, and shuts down the dispensing system.

Calibration: Equipment must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Hasstech
6985 Flanders Drive
San Diego, CA 92121
Tel: (619) 457-5880

Evaluator: Ken Wilcox Associates

Date of Evaluation: 10-15-91 & 04-10-94

LineTite Pipeline Leak Monitor

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

- Certification:** Leak rate of 0.1 gallon per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.
- Leak Threshold:** 0.062 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
- Applicability:** Gasoline, diesel, and aviation fuel.
- Specification:** System is installed on pressurized fiberglass, steel, and flexible pipelines. The rigid piping system volume must not exceed 341 gallons. The flexible piping system volume must not exceed 49.6 gallons. Tests are conducted at the line operating pressure.
- Waiting Time:** There is no waiting time between product delivery and testing. There is no waiting time between last dispensing and testing.
- Test Period:** Minimum data collection time (response time) is 50 minutes. This is a single test consisting of multiple cycles of data acquisition with 30 minutes waiting time between each cycle. Test data is acquired and recorded by a permanently installed microprocessor; calculations automatically done by the microprocessor.
- System Features:** This system is permanently installed on the pipeline and automatically tests the line. Uses a preset threshold and a single test to determine whether the pipeline is leaking. If a leak is declared, this system displays a message, triggers an alarm, and shuts down the dispensing system.
- Calibration:** Equipment must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.

Hasstech
6985 Flanders Dr.
San Diego, CA 92121
Tel: (619) 457-5880

Evaluator: Ken Wilcox Associates

Date of Evaluation: 10-15-91 & 04-10-94

Petro Comp (Overfilled Test)

VOLUMETRIC TANK TIGHTNESS TEST METHOD

- Certification:** Leak rate of 0.1 gallon per hour with $P_D = 99\%$ & $P_{FA} = 0.98\%$.
- Leak Threshold:** 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
- Applicability:** Gasoline, diesel, aviation fuel, solvents, alcohols and water.
- Capacity:** The maximum tank capacity is 15,000 gallons. The tank must be 100% full. An automatic product leveler must be used to maintain a constant product level during the test.
- Waiting Time:** There is no minimum waiting time between product delivery and test data collection. The product must be mixed continuously throughout the test.
- Test Period:** The minimum data collection time must be 2 hours after the completion of the high level circulation. The test data must be acquired and recorded by a computer after the completion of the high level circulation. There must be no dispensing or product delivery during the test.
- Temperature:** A single sensor is used to determine the temperature of the stored product.
- Ground Water:** Depth to the water table present in the backfill must be determined, and if it is above the bottom of the tank, product level must be adjusted to provide net pressure of 4 psi on the bottom of the tank.
- Calibration:** Temperature sensor is self calibrating. Level sensor must be checked annually and calibrated if necessary in accordance with manufacturer's instructions.
- Comments:** This equipment was not evaluated using manifolded tanks.

Heath Consultants Inc.
9030 Monroe Road
Houston, TX 77061
(713) 947-9292

Evaluator: Ken Wilcox Associates

Date of Evaluation: 12-15-90

Heath Consultants

Petro Tite II (Overfilled Test)

VOLUMETRIC TANK TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gallon per hour with $P_D = 99\%$ & $P_{FA} = 1\%$.

Leak Threshold: 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be 100% full.
An automatic product leveler must be used to maintain a constant product level during the test.

Waiting Time: There is no minimum waiting time between product delivery and test data collection.
The product must be mixed continuously throughout the test.
There must be no dispensing or product delivery during the test waiting time.

Test Period: The minimum data collection time must be 2 hours; test data is acquired and recorded manually.
Leak rate calculated based on cumulative volume change during low level test (generally based on one-hour average volume change).
There must be no dispensing or product delivery during the test.

Temperature: A single DTS-2000 digital sensor is used to determine the temperature of the stored product.

Ground Water: Depth to the water table present in the backfill must be determined, and if it is above the bottom of the tank, product level must be adjusted to provide net pressure of 4 psi on the bottom of the tank.

Calibration: Sensors calibration must be checked at each use and the DTS-2000 recertified a minimum of once every 3 years.

Comments: This equipment was not evaluated using manifolded tanks.

Heath Consultants Inc.
9030 Monroe Road
Houston, TX 77061
Tel: (713) 947-8292

Evaluator: Ken Wilcox Associates

Date of Evaluation: 11-01-90

Heath Consultants

Petro Tite Line Tester

LINE TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gallon per hour with $P_D = 99.99\%$ & $P_{FA} = 0.37\%$.

Leak Threshold: 0.01 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, fuel oil.

Specification: System tests fiberglass and steel piping.
The piping system volume must not exceed 129 gallons.
Tests are conducted at 150% of the line operating pressure.
The mechanical line leak detector must be removed from the pipeline system being tested.

Waiting Time: There is no minimum waiting period between product delivery and testing.
There is no minimum waiting period between last dispensing and testing.

Test Period: Minimum data collection time must be 1 hour; a bleedback must be performed and the volume change must be within the allowable bleedback time calculated.

Test data is acquired and recorded manually.

Calibration: Equipment must be calibrated annually in accordance with manufacturer's instructions.

Heath Consultants, Inc.
9030 Monroe Road
Houston, Texas 77061
(713) 947 8292

Evaluator: Ken Wilcox Associates

Date of Evaluation: 3/11/91

DRAFT

Homer Creative Products, Inc.

Homer EZY-Chek I (Overfilled Test)

VOLUMETRIC TANK TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gallon per hour with $P_D = 99\%$ & $P_{FA} = 1\%$.

Leak Threshold: 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4, solvents and waste oil.

Capacity: The maximum tank capacity is 12,000 gallons.
The tank must be 100% full.

Waiting Time: Minimum waiting time between product delivery and test data collection must be 6 hours.
Minimum waiting time between "topping off" and test data collection must be 3 hours.
Total minimum waiting time is 6 hours.
There must be no product delivery during the test waiting time.

Test Period: Minimum data collection time must be 1.5 hours (30 minute monitor period, 60 minute test period); data collection must continue until data meets manufacturer's stop test criteria.
Test data must be acquired and recorded by a strip chart recorder. Leak rate calculated from data of last 1 hour of the test period.
There must be no dispensing or product delivery during the test.

Ground Water: Depth to the water table present in the backfill must be determined, and if it is above the bottom of the tank, product level must be adjusted to provide 2-4 psi net pressure on the bottom of the tank during the test. Ground water level must be stable prior to and during the test.

Calibration: Level sensors must be calibrated before each test.
Temperature sensor must be calibrated annually.

Comments: This equipment was not evaluated using manifolded tanks.

Homer Creative Products
212 Morton Street
Bay City, MI 48706
Tel: (517) 893-3360

Evaluator: W. A. Kibbe & Associates

Date of Evaluation: 10-03-90

DRAFT

Homer Creative Products, Inc.

Homer EZY-Chek II (Overfilled Test)

VOLUMETRIC TANK TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gallon per hour with $P_D = 99.95\%$ & $P_{FA} = 0.05\%$.

Leak Threshold: 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4, solvents and waste oil.

Capacity: The maximum tank capacity is 12,000 gallons.
The tank must be 100% full.

Waiting Time: Minimum waiting time between product delivery and test data collection must be 6 hours; minimum waiting time between "topping off" and test data collection must be 3 hours.
Total minimum waiting time is 6 hours.
There must be no product delivery during the test waiting time.

Test Period: The minimum data collection time must be one hour and forty minutes (33 minutes monitor mode and 67 minutes test mode).
Leak rate is calculated from data of last 67 minutes of test period.
At the conclusion of the test mode, data must be checked for the manufacturer's stop test criteria, if data does not meet the criteria data collection must continue.
Test data must be acquired and recorded by a computer.
There must be no dispensing or product delivery during the test.

Ground Water: Depth to the water table present in the backfill must be determined and if it is above the bottom of the tank, product level must be adjusted to provide 2-4 psi net pressure on the bottom of the tank during the test. Ground water level must be stable prior to and during the test.

Calibration: Load cell must be calibrated before each use.

Comments: This equipment was not evaluated using manifolded tanks.

Homer Creative Products
212 Morton Street
Bay City, MI 48706
(517) 893-3360

Evaluator: W. A. Kibbe & Associates

Evaluation Completed: 09-18-90

Horner Creative Products, Inc.

Horner EZY-Chek II (Underfilled Test)

VOLUMETRIC TANK TIGHTNESS TEST METHOD

Certification:	Leak rate of 0.1 gallon per hour with $P_D = 95.79\%$ & $P_{FA} = 4.21\%$.
Leak Threshold:	0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
Applicability:	Gasoline, diesel, aviation fuel, fuel oil #4, waste oil and solvents.
Capacity:	The maximum tank capacity is 12,000 gallons. The tank must be between 98 to 100% full.
Waiting Time:	Minimum waiting time between product delivery and test data collection must be 8 hours. There must be no product delivery during the test waiting time.
Test Period:	Minimum data collection time must be one hour and forty minutes (33 minutes monitor mode and 67 minutes test mode). The test data must be acquired and recorded by a computer. Leak rate calculated from data of last 67 minutes of test period. There must be no dispensing or product delivery during the test. At the conclusion of the test mode, data must be checked for the manufacturer's stop test criteria. If data does not meet the criteria data collection must continue.
Ground Water:	Depth to the water table present in the backfill must be determined and if it is above the bottom of the tank, product level must be adjusted to provide at least 1 psi net pressure on the bottom of the tank during the test. If this can not be accomplished, then the tank can not be tested using this method.
Calibration:	Load cell must be calibrated before each use.
Comments:	This equipment was not evaluated using manifolded tanks.

Horner Creative Products
212 Morton Street
Bay City, MI 48706
Tel: (517) 893-3360

Evaluator: W. A. Kibbe & Associates

Date of Evaluation: 08-25-90

Horner Creative Products, Inc.

EZY 3 (Underfilled Test)

NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD

Certification:	Leak rate of 0.1 gallon per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.
Leak Threshold:	A leak is declared if the pressure decay is greater than 1 inch water column pressure for non-volatile products and 10% of the lower determined pressure for volatile products. A leak is also declared if water incursion is detected.
Applicability:	Gasoline, diesel, aviation fuel, fuel oil #4, fuel oil #6, solvents and waste oil.
Capacity:	The Maximum tank capacity is 12,000 gallons if ground water is not present. Larger tanks may be tested if groundwater is present and a negative pressure of 1.0 to 1.7 psi can be maintained at bottom of tank. The ullage volume must be between 500 and 2500 gallons.
Test Period:	The minimum data collection time must be 2 and 1/2 hours for gasoline and 1 and 1/4 hours for diesel. This data collection time includes the time required to apply vacuum and to saturate the ullage with vapors. Test data is acquired manually and recorded by computer.
Water Sensor:	A water sensor must be used to detect water incursion and must be calibrated for every test. In accordance with manufacturer's procedures, this calibration may determine the length of the test in presence of groundwater.
Ground Water:	Depth to the water table present in the backfill must be determined, and if it is above the bottom of the tank, test time must be extended to allow sufficient time to detect 0.1 gph incursion of water into the tank.
Vacuum:	The minimum vacuum at the bottom of the tank must be at 0.1 to 1.7 psi below the atmospheric pressure.

Horner Creative Products, Inc.
212 Morton Street
Bay City, Michigan 48706
(517) 893-3360

Evaluator: Ken Wilcox Associates

Date of Evaluation: 08-23-94

EZY-Chek Manual Line Leak Detector

LINE TIGHTNESS TEST METHOD

- Certification:** Leak rate of 0.1 gallon per hour with $P_D = 98.0\%$ & $P_{FA} = 1\%$.
- Leak Threshold:** 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, solvents and waste oil.
- Specification:** System tests fiberglass and steel piping.
The piping system volume must not exceed 129 gallons.
Tests are conducted at 150% of the line operating pressure.
- Waiting Time:** No waiting time between last delivery of the product to the tank and the start of data collection.
Waiting time between last dispensing of product through the pipeline system and the start of data collection is zero hours.
- Test Period:** The minimum data collection time for the test must be one and half hours.
Data must be collected every 15 minutes.
Data collection period consists of a monitor mode and test mode.
Data must be collected in the monitor mode until two consecutive records are within 0.01 gallon of each other.
Four data points must be taken in the test mode for a final gallon per hour result.
Test data is acquired and recorded manually.
Manual calculations performed by the operator on site.
- Calibration:** No temperature sensors used. No calibration required. Equipment must be checked annually in accordance with manufacturer's instructions.

Homer Creative Products
212 Morton Street
Bay City, MI 48706
Tel: (517) 893-3360

Evaluator: Ken Wilcox Associates

Date of Evaluation: 07-09-92

EZY-Chek II Automatic Line Leak Detector

LINE TIGHTNESS TEST METHOD

- Certification:** Leak rate of 0.1 gallon per hour with $P_D = 99.0\%$ & $P_{FA} = 1\%$.
- Leak Threshold:** 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, solvents and waste oil.
- Specification:** System tests fiberglass and steel piping.
The piping system volume must not exceed 129 gallons.
Tests are conducted at 150% of the line operating pressure.
- Waiting Time:** No waiting time between last delivery of the product to the tank and the start of data collection.
Waiting time between last dispensing of product through the pipeline system and the start of data collection is zero hours.
- Test Period:** The minimum data collection time for the test must be 2 hours.
Data must be collected every 30 seconds.
Data collection period consists of a monitor mode and test mode.
Data must be collected in the monitor mode until two consecutive 15-minute records are within 0.01 gallon of each other; An additional 15-minute in the monitor mode is required before start of the test mode.
Data must be collected in the test mode for 67 minutes for a final gallon per hour result.
Test data is acquired and recorded by a microprocessor.
Calculations are automatically done with a microprocessor.
- Calibration:** Sensors are calibrated before each test.

Homer Creative Products
212 Morton Street
Bay City, MI 48706
Tel: (517) 893-3360

Evaluator: Ken Wilcox Associates

Date of Evaluation: 07-13-92

Homer Creative Products

SIR PRO 1 Version 1.0 (qualitative)

STATISTICAL INVENTORY RECONCILIATION TEST METHOD

Certification: Version 1.0 is designed to meet monthly monitoring requirements. Method is certified to detect a 0.2 gph leak rate with a $P_D=100\%$ & $P_{FA}=0\%$.

Leak Threshold: A leak is declared when leak rate exceeds 0.10 gallons per hour.

Applicability: Gasoline, diesel, aviation fuel, and fuel oil #4.

Tank Capacity: Maximum tank capacity may not exceed 18,000 gallons.

Data Requirement: A minimum of 30 days of product level and flow through data.

Comments: Of the 120 data sets presented for evaluation, 10 were inconclusive.

The median monthly throughput for tanks used in this evaluation was 13,640 gallons.

This evaluation did not include data from manifolded tanks.

Data sets used in this evaluation were supplied by the evaluator.

A single leak rate of 0.2 gph was used in this evaluation.

Homer Creative Products
212 Morton Street
Bay City, Michigan 48706
(517) 893-3360

Evaluator: Petro Works

Date of Evaluation: 04-07-93

Homer Creative Products

SIR PRO 1 Version 2.0 (qualitative)

STATISTICAL INVENTORY RECONCILIATION TEST METHOD

Certification: Version 2.0 is designed to meet annual test requirements. Method is certified to detect a 0.1 gph leak rate with a $P_D=100\%$ & $P_{FA}=0\%$.

Leak Threshold: A leak is declared when the leak rate exceeds 0.05 gph.

Product Applicability: Gasoline, diesel, aviation fuel, and fuel oil #4.

Tank Capacity: Maximum tank capacity may not exceed 18,000 gallons.

Data Requirement: A minimum of 30 days of product level and flow through data.

Comments: Of the 120 data sets presented for evaluation, 9 were inconclusive.

The median monthly throughput for tanks used in this evaluation was 11,828 gallons.

This evaluation did not include data from manifolded tanks.

Data sets used in this evaluation were supplied by the evaluator.

A single leak rate of 0.1 gph was used in this evaluation.

Homer Creative Products
212 Morton Street
Bay City, Michigan 48706
(517) 893-3360

Evaluator: Petro Works

Date of Evaluation: 09-10-93

DRAFT

Ibex Industries

Ibex Precision Test System (Overfilled)

VOLUMETRIC TANK TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gallon per hour with $P_D = 99.5\%$ & $P_{FA} = 0.5\%$.

Leak Threshold: 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4, and solvent.

Capacity: The maximum tank capacity is 18,000 gallons.
The tank must be 92% to 100% full.

Waiting Time: Minimum waiting time between product delivery and test data collection must be 12 hours.
Minimum waiting time between "topping off" and test data collection must be 3 hours.
There must be no product delivery during the waiting time.

Test Period: Test data must be acquired and recorded by a computer.
Leak rate calculated from data determined valid by statistical analysis.
There must be no dispensing or product delivery during the test.

Temperature: A minimum of 6 temperature sensors must be used to determine the average temperature of the stored product.

Ground Water: Depth to the water table present in the backfill must be determined, and if it is above the bottom of the tank, product level must be adjusted to provide 2-4 psi net pressure on the bottom of the tank.

Calibration: Level sensors must be calibrated before each test.

Comments: The equipment was not evaluated using manifolded tanks.

Ibex Industries
2014 S. Union Ave., Suite 103
Bakersfield, CA 93307
Tel: (805) 835-8910

Evaluator: Applied Research Center

Date of Evaluation: 01-18-91

DRAFT

IMO Industries Inc., Gems Sensors Division

Gems Smartwell Portable Monitor model WPM-535
with Groundwater Probe model WP-535

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type:	qualitative
Sampling frequency:	intermittent*
Operating principle:	conductive polymer

Test Results:

	Commercial Gasoline	Synthetic Gasoline
* Accuracy(%)	100	100
Detection time(min:sec)	09:31	07:05
Fall Time (min:sec)	55:42	17:04
Lower detection limit(cm)	0.04	0.08

Specificity Results:

Activated: commercial gasoline, n-Hexane, diesel fuel, Jet-A fuel, toluene, synthetic gasoline, xylene(s).

Manufacturer's Specifications:

Comments:

* Although the sensor is a polymer strip which is mounted in the monitoring well, the monitor is a hand held unit which is typically connected to the sensor periodically - hence the "intermittent" designation.

EPA and many states require detection of 1/8 inch of product, which is 0.32 cm. This detector is reusable.

IMO Industries Inc.
Gems Sensors Division
Cowles Road
Plainville, CT 06062-1198
Tel: (203) 747-3000

Evaluator: Carnegie Mellon Research Institute

Date of evaluation: 04-22-93

TS 1000 Magnetostrictive Probe

AUTOMATIC TANK GAUGING SYSTEM

Certification:	Leak rate of 0.2 gallon per hour with $P_D = 99.99\%$ & $P_{FA} = 0.8\%$.
Leak Threshold:	0.05 gallon per hour (a leak is declared if the measured slope by the system exceeds this threshold).
Applicability:	Gasoline, diesel, aviation fuel, and solvents with known coefficients of expansion.
Capacity:	The maximum tank capacity is 15,000 gallons. The tank must be between 50 and 95% full.
Waiting Time:	Minimum waiting time between product delivery to the tank and test data collection must be 6 hours. Minimum waiting time between last dispensing and test data collection must be 2 hours.
Test Period:	The minimum data collection time must be 4 hours. Test data must be acquired and recorded by a computer. Leak rate is calculated from data determined to be valid by statistical analysis. There must be no dispensing or product during the test.
Temperature:	A minimum of 5 Resistance Temperature Detectors must be used to determine the average temperature of the stored hazardous substance.
Water Sensor:	A water sensor must be used to detect water incursion. Minimum water level detectable in the tank is 1.04 inches. Minimum detectable water level change is 0.024 inches.
Calibration:	Temperature sensors and probe must be checked and calibrated annually in accordance with manufacturer's instructions.
Comments:	This equipment was not evaluated using manifolded tanks. This equipment only tests the portion of the tank that contains product. As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure). 3rd party certification for 0.1 gph on this equipment is still under review.

Incon Environmental
P. O. Box 638
Saco, ME 04072
Tel: (800) 872-3455

Evaluator: Ken Wilcox Associates

Date of Evaluation: 8/5/92

TS 2000 Magnetostrictive Probe

AUTOMATIC TANK GAUGING SYSTEM

Certification:	Leak rate of 0.2 gallon per hour with $P_D = 99.9\%$ & $P_{FA} = 0.5\%$.
Leak Threshold:	0.058 gallon per hour (a leak is declared if the measured slope by the system exceeds this threshold).
Applicability:	Gasoline, diesel, aviation fuel, and solvents with known coefficients of expansion.
Capacity:	The maximum tank capacity is 15,000 gallons. The tank must be between 50 and 95% full.
Waiting Time:	Minimum waiting time between product delivery to the tank and test data collection must be 6 hours. Minimum waiting time between last dispensing and test data collection must be 2 hours.
Test Period:	The minimum data collection time must be 6 hours. Test data must be acquired and recorded by a computer. Leak rate is calculated from data determined to be valid by statistical analysis. There must be no dispensing or product delivery during the test.
Temperature:	A minimum of 5 temperature sensors must be used to determine the average temperature of the hazardous substance.
Water Sensor:	A water sensor must be used to detect water incursion. Minimum water level detectable in the tank is 1.04 inches. Minimum detectable water level change is 0.024 inches.
Calibration:	Temperature sensors and probe must be checked and calibrated annually in accordance with manufacturer's instructions.
Comments:	This equipment was not evaluated using manifolded tanks. This equipment only tests the portion of the tank that contains product. As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure). 3rd party certification for 0.1 gph on this equipment is still under review.

Incon Environmental
P. O. Box 638
Saco, ME 04072
Tel: (800) 872-3455

Evaluator: Ken Wilcox Associates

Date of Evaluation: 5/10/91

DRAFT

In-Situ, Inc.

Leak Detection Systems,
KW-140 / KW-240 Monitors with Type 1 Sensor

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: product soluble

Test Results:

	Commercial Gasoline	Synthetic Gasoline
Accuracy (%)	100	100
Detection Time (min:sec)	00:24	00:09
Fall Time (min:sec)	Not App.	Not App.
Lower Detection Limit (cm)	0.01	0.01

Specificity Results:

Activated: commercial gasoline, n-Hexane, diesel fuel, Jet-A jet fuel, toluene, synthetic gasoline, xylene(s).

Manufacturer's specification:

Type 1 sensor is recommended by manufacturer for detecting liquid and vapor gasoline, alcohol-blend fuels, and JP4 in wet or dry monitor wells.

Comments: EPA and many states require detection 1/8 inch of product, which is 0.32 cm. This detector is not reusable, and must be replaced after contact with hydrocarbons.

In-Situ, Inc.
210 South Third Street
Laramie, WY 82070-0920
Tel: (307) 742-8213

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 07-29-91

DRAFT

In-Situ, Inc.

Leak Detection Systems,
KW-140 / KW-240 Monitors with Type 2 Sensor

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating Principle: product soluble

Test Results:

	Commercial Gasoline	Synthetic Gasoline
Accuracy (%)	100	100
Detection Time (min:sec)	14:39	08:45
Fall Time (min:sec)	Not App.	Not App.
Lower Detection Limit (cm)	0.01	0.01

Specificity Results:

Activated: commercial gasoline, n-Hexane, diesel fuel, Jet-A fuel, toluene, synthetic gasoline, xylene(s).

Manufacturer's Specifications:

Type 2 sensor is recommended by manufacturer for detecting diesel, heating oil (No. 1 & 2), A2M, JP4, JP5, gasoline, and alcohol blend fuels in wet monitoring wells only.

Comments: EPA and many states require detection of 1/8 inch of product, which is 0.32 cm. This detector is not reusable, and must be replaced after contact with hydrocarbons.

In-Situ, Inc.
210 South Third Street
Laramie, WY 82070-0920
Tel: (307) 742-8213

Evaluator: Carnegie Mellon Research Institute

Date of evaluation: 07-29-91

VOLUMETRIC TANK TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gallon per hour with $P_D = 99.98\%$ & $P_{FA} = 0.02\%$.

Leak Threshold: 0.05 gallon per hour if groundwater presence is determined (a leak is declared if the output of the measurement system exceeds this threshold). If using 2 level testing, the level is changed by 3 feet between the two tests and if the net change between the two tests is greater than 0.02 gph, a leak is declared.

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4, solvents, waste oil and other liquids that flow under ambient conditions.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be 100% full.

Waiting Time: Minimum waiting time between product delivery and test data collection is variable dependent on site conditions but must not be less than 6 hours. Minimum waiting time between "topping off" and test data collection must be 1 hour.
There must be no dispensing or product delivery during the test waiting time.

Test Period: The minimum data collection time must be 1 hour.
Test data must be acquired and recorded by a computer.
Leak rate calculated from data determined to be valid by statistical analysis.

Ground Water: If depth to the water table is determined and it is above the bottom of the tank, the product level must be adjusted to provide height differential of 3 feet between the product and water in the backfill. If depth to the water table is not determined, 2 tests must be performed with a level change of at least 3 feet between tests.

Calibration: The level sensors must be calibrated before each test.

Comments: This equipment was not evaluated using manifolded tanks.
The evaluation of this equipment did not include a field evaluation of the ground water compensation by two level testing.

Leak Detection Systems, Inc.
152 King Street
Cohasset, MA 02025
Tel: (617) 383-2305

Evaluator: Ken Wilcox Associates

Date of Evaluation: 11-29-91

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: electrical conductivity

Test Results:

	Commercial Gasoline	Synthetic Gasoline	Jet Fuel (JP-4)
Accuracy(%)	100	100	100
Detection time(sec)	4	7	2
Fall time (sec)	3	4	4
Lower detection limit(cm)	0.08-0.32	0.08-0.32	0.08-0.32

Specificity Results:

Activated: commercial gasoline, toluene, n-Hexane, diesel fuel, jet-A fuel, JP-4 jet fuel, synthetic gasoline, xylene(s).

Manufacturer's Specifications:

Comments: EPA and many states require detection of 1/8 inch of product, which is 0.32 cm. Evaluation was conducted on probe FD221G/TRA, which has identical performance to probes listed, according to manufacturer. Probes beginning with "MD" have identical performance as older probes beginning with "FD," according to manufacturer. The test procedures used were those in Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Liquid-Phase ASTM-Formatted Methods," June 29, 1990.

Mallory Controls
2831 Waterfront Pkwy. E. Dr.
Indianapolis, IN 46214
Tel: (800) 343-2125

Evaluator: Radian Corporation

Date of Evaluation: 07-08-91

DRAFT

Mallory Controls

Pollulert Probes MD241R, MD241RRA, MD241G, MD241GRA

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
 Sampling frequency: continuous
 Operating principle: electrical conductivity

Test Results:

	Commercial Gasoline	Synthetic Gasoline	Jet Fuel (JP-4)
Accuracy(%)	100	100	100
Detection time(sec)	2	2	1
Fall Time (sec)	1	2	2
Lower detection limit(cm)	0.16-0.32	0.16-0.32	0.16-0.32

Specificity Results:

Activated: commercial gasoline, n-Hexane, diesel fuel, Jet-A fuel, toluene, JP-4 jet fuel, synthetic gasoline, xylene(s).

Manufacturer's Specifications:

Comments: EPA and many states require detection of 1/8 inch of product, which is 0.32 cm. Evaluation was conducted on probe FD241R, which has identical performance to probes listed, according to manufacturer. Probes beginning with "MD" have identical performance as older probes beginning with "FD," according to manufacturer. The test procedures used were those in Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Liquid-Phase ASTM-Formatted Methods," June 29, 1990.

Mallory Controls
 2831 Waterfront Pkwy. E. Dr.
 Indianapolis, IN 46214
 Tel: (800) 343-2126

Evaluator: Radian Corporation

Date of Evaluation: 07-08-91

DRAFT

Mallory Controls

Pollulert Probes MD221V, MD221VRA, MD210V, MD210VRA

VAPOR PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
 Sampling frequency: continuous
 Operating principle: adsistor

Test Results:

	Commercial Gasoline	Synthetic Gasoline	JP-4
Accuracy (%)	100	100	100
Detection Time (sec):	91	65	86
Fall Time (min:sec):	5:39	4:23	9:38
Lower Detection Limit (ppm):	10 to 100	10 to 500	10 to 50

Specificity Results:

Activated: commercial gasoline, JP-4 jet fuel, synthetic gasoline, toluene, xylene(s)
 Not activated: n-Hexane

Manufacturer's Specifications:

Comments: Evaluation was conducted on probe FD221V, which has identical performance to probes listed, according to manufacturer. Probes beginning with "MD" have identical performance as older probes beginning with "FD," according to manufacturer. The test procedures used were those in Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods," June 29, 1990.

Mallory Controls
 2831 Waterfront Pkwy. E. Dr.
 Indianapolis, IN 46214
 Tel: (800) 343-2126

Evaluator: Radian Corporation

Date of Evaluation: 07-08-91

DRAFT

Marley Pump Co.

Sonic Technology (ST) 1400-1800 Series Tank Monitoring System (Ultrasonic Transducer)
 ATG Automatic Tank Gauging Monitor, LLM Series Liquid Level Monitor
 FMS Fuel Management Monitor

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.2 gallon per hour with $P_D=100\%$ & $P_{FA}=0\%$.

Leak Threshold: 0.1 gallon per hour (a leak is declared if the output of the system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, and solvents.

Capacity: The maximum tank capacity is 18,000 gallons.
The tank must be between 50 and 95% full.

Waiting Time: Minimum waiting time between product delivery to the tank and test data collection must be 10 hours.

Test Period: The minimum data collection time must be 2.35 hours.
Test data must be acquired and recorded by a computer.
Leak rate is calculated from all data collected.
There must be no dispensing or product delivery during the test.

Temperature: A minimum of 5 temperature sensors are used to determine the average temperature of the stored product.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 0.112 inches.
Minimum detectable water level change is 0.011 inches.

Calibration: Temperature sensors and probe must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: The equipment was not evaluated using manifolded tanks.
This equipment only tests the portion of the tank that contains product.
As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).
This system was previously known as the LT1 Automatic Product Level Monitor and was manufactured by Level Tech, Inc. (purchased by Marley 9/91).

Marley Pump Co.
 5800 Foxridge Drive
 Mission, KS 66202
 Tel: (913) 831-5700

Evaluator: ADA Technologies

Date of Evaluation: 09-30-92

DRAFT

Marley Pump Co.

Sonic Technology (ST) 1400-1800 Series Tank Monitoring System (Ultrasonic Transducer)
 ATG Automatic Tank Gauging Monitor, LLM Series Liquid Level Monitor,
 FMS Fuel Management Monitor

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.1 gallon per hour with $P_D=99.9\%$ & $P_{FA}=0.01\%$.

Leak Threshold: 0.05 gallon per hour (a leak is declared if the output of the system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4, fuel oil #6, and some solvents.

Capacity: The maximum tank capacity is 18,000 gallons.
The tank must be 95% full.

Waiting Time: Minimum waiting time between product delivery to the tank and test data collection must be 12 hours.

Test Period: The minimum data collection time must be 2.35 hours.
Test data must be acquired and recorded by a computer.
Leak rate is calculated from all data collected.
There must be no dispensing or product delivery during the test.

Temperature: A minimum of 5 temperature sensors are used to determine the average temperature of the stored product.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 0.112 inches.
Minimum detectable water level change is 0.011 inches.

Calibration: Temperature sensors and probe must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: The equipment was not evaluated using manifolded tanks.
This equipment only tests the portion of the tank that contains product.
As the product level is lowered, the leak rate in a leaking tank decreases (due to lower head pressure).
This system was previously known as the LT1 Automatic Product Level Monitor and was manufactured by Level Tech, Inc. (purchased by Marley 9/91).

Marley Pump Co.
 5800 Foxridge Drive
 Mission, KS 66202
 Tel: (913) 831-5700

Evaluator: ADA Technologies, Inc.

Date of Evaluation: 09-25-92

DRAFT

Marley Pump Co.

Red Jacket ATM System,
Ver. RLM 5000, 5001, and 9000

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.2 gallon per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.

Leak Threshold: 0.1 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, and solvent.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be between 50 and 95% full.

Waiting Time: Minimum waiting time between product delivery to the tank and test data collection must be 6 hours.

Test Period: The minimum data collection time must be 3 hours.
Test data must be acquired and recorded by a computer.
There must be no dispensing or product delivery during the test.

Temperature: A minimum of 5 temperature sensors must be used to determine the average temperature of the stored hazardous substance.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 1.04 inches.
Minimum detectable water level change is 0.011 inches.

Calibration: Temperature sensors and probe must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: The equipment was not evaluated using manifolded tanks.
This equipment only tests the portion of the tank that contains product.
As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).

Marley Pump Co.
5800 Foxridge Drive
Mission, KS 66202
Tel: (913) 831-5700

Evaluator: Ken Wilcox Associates

Date of Evaluation: 04/02/91

DRAFT

Marley Pump Co.

Red Jacket PPM 4000, RLM 9000, RLM 10000, ST 1401, ST 1401L, ST 1801, and ST1801L

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

Certification: Leak rate of 3 gallons per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.

Leak Threshold: 3 gallons per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel and solvent.

Specification: System is installed on pressurized fiberglass and steel piping.
The piping system volume must not exceed 56 gallons.
Tests are conducted at 5-10 psi.

Waiting Time: There is no waiting period between product delivery and testing.
There is no waiting period between last dispensing and testing.

Test Period: The minimum data collection time (response time) for the test is 1 second.
Test data must be acquired and recorded by a microprocessor.
Calculations are automatically done by the microprocessor.

System Features: This system is permanently installed on the pipeline and automatically tests the line.
Uses a preset threshold and a single test to determine whether the pipeline is leaking.
This system records and displays day, date, time of positive test.
If a leak is declared, this system displays a message, triggers an alarm, and shuts down the dispensing system.

Calibration: Sensor must be checked and calibrated annually in accordance with manufacturer's instructions.

Marley Pump Co.
5800 Foxridge Drive
Mission, KS 66202
Tel: (913) 831-5700

Evaluator: Ken Wilcox Associates

Date of Evaluation: 3/11/91

DRAFT

Marley Pump Co.

Red Jacket PPM 4000, RLM 9000, RLM 10000, ST 1401, ST 1401L, ST 1801, and ST1801L

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR (annual test)

Certification: Leak rate of 0.1 gallon per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.

Leak Threshold: 0.047 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel and solvent.

Specification: System is installed on pressurized fiberglass and steel piping.
The piping system volume must not exceed 56 gallons.
Tests are conducted at 10 psi.

Waiting Time: There is no waiting period between product delivery and testing.
There is no waiting period between last dispensing and testing.

Test Period: The minimum data collection time must be 2.5 hours.
Test data must be acquired and recorded by a microprocessor.
Calculations are automatically done by the microprocessor.

System Features: This system is permanently installed on the pipeline and automatically tests the line.
Uses a preset threshold and a single test to determine whether the pipeline is leaking.
This system records and displays day, date, time of positive test.
If a leak is declared, this system displays a message, triggers an alarm, and shuts down the dispensing system.

Calibration: Sensor must be checked and calibrated annually in accordance with manufacturer's instructions.

Marley Pump Co.
5800 Foxridge Drive
Mission, KS 66202
Tel: (913) 813-5700

Evaluator: Ken Wilcox Associates

Date of Evaluation: 3/11/91

DRAFT

Marley Pump Co.

Red Jacket DLD and XLD

MECHANICAL LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gallon per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.

Leak Threshold: 2.0 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel and solvent.

Specification: System is installed on pressurized fiberglass and steel piping.
The piping system volume must not exceed 129 gallons.
Tests are conducted at 8-12 psi.

Waiting Time: There is no waiting period between product delivery and testing.
There is no waiting period between last dispensing and testing.

Test Period: The minimum test time (response time) is 6 seconds.

System Features: This system is permanently installed on the piping and automatically tests the line. It uses a preset threshold and a single test to determine whether the piping is leaking.
If a leak is detected, this system restricts fuel flow to dispenser.

Calibration: Equipment must be checked annually in accordance with manufacturer's instructions.

Marley Pump Co.
5800 Foxridge Drive
Mission, KS 66202
Tel: (913) 813-5700

Evaluator: Ken Wilcox Associates

Date of Evaluation: 12/21/90

DRAFT

Marley Pump Co.

Red Jacket FX1/FX2

MECHANICAL LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gallons per hour with $P_D=100\%$ & $P_{FA}=0\%$.

Leak Threshold: 2.0 gallons per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, and some solvents.

Specification: System is installed on pressurized fiberglass or steel. The piping system volume must not exceed 257 gallons. Tests are conducted at 8-12 psi.

Waiting Time: There is no waiting period between delivery and testing. There is no waiting period between last dispensing and testing. Stabilization time up to 45 minutes after dispensing may be required when temperature extremes are present.

Test Period: The test time (response time) is less than 5 minutes.

System Features: This system is permanently installed on the piping and automatically tests the line. It uses a preset threshold and a single test to determine whether the piping is leaking. If a leak is detected, this system restricts flow to the dispenser.

Calibration: Equipment must be checked annually for capability of detecting a leak of 3.0 gallons per hour in accordance with manufacturer's instructions.

Marley Pump Co.
5800 Foxridge Drive
Mission, KS 66202
Tel: (913) 813-5700

Evaluator: Ken Wilcox Associates

Date of Evaluation: 3/14/94

DRAFT

Marley Pump Co.

Red Jacket FX1/FX2 Flexline

MECHANICAL LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gallons per hour with $P_D=100\%$ & $P_{FA}=0\%$.

Leak Threshold: 2.0 gallons per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, and some solvents.

Specification: System is installed on flexible pipeline. The piping system volume must not exceed 49.6 gallons.

Waiting Time: There is no waiting period between delivery and testing. There is no waiting period between last dispensing and testing.

Test Period: The test time (response time) is less than 3 minutes.

System Features: This system is permanently installed on the piping and automatically tests the line. It uses a preset threshold and a single test to determine whether the piping is leaking. If a leak is detected, this system restricts flow to the dispenser.

Calibration: Equipment must be checked annually for capability of detecting a leak of 3.0 gallons per hour in accordance with manufacturer's instructions.

Comments: Enviroflex pipeline was used during this evaluation which had a bulk modulus of 1,280 psi. In order for the leak detector to have adequate test, time delays must be integrated into the electronic dispensing equipment or retrofitted in the junction box. Without this delay, the nozzles cannot be guaranteed being closed for sufficient time to allow the leak detector to compile its line test and provide uninterrupted service.

Marley Pump Co.
5800 Foxridge Drive
Mission, KS 66202
Tel: (913) 813-5700

Evaluator: Ken Wilcox Associates

Date of Evaluation: 3/22/94

DRAFT

Marley Pump Co.

Red Jacket FX2/FX2-D (Bigflow)

MECHANICAL LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gallons per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.

Leak Threshold: 2.0 gallons per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel.

Specification: System is installed on pressurized fiberglass or steel. The piping system volume must not exceed 362 gallons. Tests are conducted at 8-12 psi.

Waiting Time: There is no waiting period between delivery and testing.
There is no waiting period between last dispensing and testing.
Stabilization time up to 45 minutes after dispensing may be required when temperature extremes are present.

Test Period: The minimum test time (response time) is 3 minutes.

System Features: This system is permanently installed on the piping system and automatically tests the line. It uses a preset threshold and a single test to determine whether the piping is leaking. If a leak is detected, this system restricts flow to the dispenser.

Calibration: Equipment must be checked annually for capability of detecting a leak of 3.0 gallons per hour in accordance with manufacturer's instructions.

Marley Pump Co.
5800 Foxridge Drive
Mission, KS 66202
Tel: (913) 813-5700

Evaluator: Ken Wilcox Associates

Dates of Evaluation: 3/15/94 & 6/1/94

DRAFT

Marley Pump Co.

Red Jacket XLP

MECHANICAL LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gallon per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.

Leak Threshold: 2.0 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel and solvent.

Specification: System is installed on pressurized fiberglass and steel piping.
The piping system volume must not exceed 129 gallons.
Tests are conducted at 15-22 psi.

Waiting Time: There is no waiting period between delivery and testing.
There is no waiting period between last dispensing and testing.

Test Period: The minimum test time (response time) is 6 seconds.

System Features: This system is permanently installed on the piping and automatically tests the line. It uses a preset threshold and a single test to determine whether the piping is leaking.
If a leak is detected, this system restricts fuel flow to dispenser.

Calibration: Equipment must be checked annually in accordance with manufacturer's instructions.

Marley Pump Co.
5800 Foxridge Drive
Mission, KS 66202
Tel: (913) 813-5700

Evaluator: Ken Wilcox Associates

Date of Evaluation: 12/21/90

DRAFT

Marley Pump Co.

Red Jacket XLP

MECHANICAL LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gallon per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.

Leak Threshold: 2.0 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel and solvent.

Specification: System is installed on pressurized flexible piping.
The piping system volume must not exceed 48.9 gallons.
Tests are conducted at operating pressure.

Waiting Time: There is no waiting period between delivery and testing.
There is no waiting period between last dispensing and testing.

Test Period: The minimum test time (response time) is less than 3 minutes.

System Features: This system is permanently installed on the piping and automatically tests the line. It uses a preset threshold and a single test to determine whether the piping is leaking.
If a leak is detected, this system restricts fuel flow to dispenser.

Calibration: Equipment must be checked annually in accordance with manufacturer's instructions.

Marley Pump Co.
5800 Foxridge Drive
Mission, KS 66202
Tel: (913) 813-5700

Evaluator: Ken Wilcox Associates

Date of Evaluation: 04/19/93

DRAFT

Mine Safety Appliances

Tankgard

Version: P/N 481532 S/N 03095

VAPOR PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: quantitative
Sampling frequency: continuous
Operating principle: metal oxide semiconductor

Test Results:

	<u>Benzene</u>	<u>2-Methylbutane</u>
Accuracy (%):	100	100
Detection Time (sec):	5	16
Fall Time (min:sec):	04:12	04:42
Lower Detection Limit(ppm):	12.5	12.5

Specificity Results:

Activated (100%): Benzene, n-Butane, n-Hexane, 2-Methylpentane, Toluene, Isobutane

Manufacturer's Specifications:

Maximum Wire Distance: 500 ft using 18 AWG
Response Time: 30 seconds
Recover Time: 1 minute maximum
Sensor Life: 2 year warranty

Mine Safety Appliances
P. O. Box 427
Pittsburgh, PA 15230
Tel: (412) 778-8600

Evaluator: Carnegie Mellon Research Institution

Date of Evaluation: 3/26/91

Mine Safety Appliances

Tankgard VIII
Version: P/N 488803 S/N 00389

VAPOR PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: quantitative
Sampling frequency: continuous
Operating principle: metal oxide semiconductor

Test Results:

	<u>Benzene</u>	<u>2-Methylbutane</u>
Accuracy (%):	100	100
Detection Time (sec):	5	16
Fall Time (min:sec):	04:12	04:42
Lower Detection Limit (ppm):	12.5	12.5

Specificity Results:

Activated(100%): benzene, n-Butane, n-Hexane, isobutane, 2-methylpentane, toluene

Manufacturer's Specifications:

Maximum Wire Distance: 500 ft using 18 AWG
Response Time: 30 seconds
Recover Time: 1 minute maximum
Sensor Life: 2 year warranty

Mine Safety Appliances
P. O. Box 427
Pittsburgh, PA 15230
Tel: (412) 776-8600

Evaluator: Carnegie Mellon Research Institution

Date of Evaluation: 3/28/91

NDE Environmental

Computerized VPLT Underfilled Tank Tightness Testing System

VOLUMETRIC TANK TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gallon per hour with $P_D = 99.9\%$ & $P_{FA} = 0.1\%$.

Leak Threshold: 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4, fuel oil #6, solvents, waste oil and other products.

Capacity: The maximum tank capacity is 18,000 gallons.
The tank must contain at least 24 inches of product.

Waiting Time: The waiting time between product delivery to tank and test data collection must be long enough to ensure a temperature change of less than 0.09 °F/hr, typically at least 2 hours.

Test Period: The minimum data collection time must be 2 hours.
Test data must be acquired and recorded by a computer.
Leak rate is calculated from average over data window.
There must be no dispensing or product delivery during the test.

Temperature: Typically 5 thermistors are used to determine the average temperature of the stored product. A minimum of one is required.

Ground Water: Depth to the water table present in the backfill must be determined, and if it is above the bottom of the tank, the product level in the tank is adjusted to provide minimum of 1 psi pressure differential, positive or negative, on the bottom of the tank during the test.

Calibration: Sensors must be checked and calibrated annually.

Comments:

1. The equipment was not evaluated using manifolded tanks.
2. This equipment only tests the portion of the tank that contains product.
3. As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).

NDE Environmental
8906 Wall Street, Suite 306
Austin, TX 78754
Tel: (800) 800-4633

Evaluator: Ken Wilcox Assoc.

Date of Evaluation: 02-15-93

Sure Test - Assured Tight System, Series IV (Underfilled Test)

VOLUMETRIC TANK TIGHTNESS TEST METHOD

Certification:	Leak rate of 0.1 gallon per hour with $P_D = 99.99\%$ & $P_{FA} = 0.005\%$.
Leak Threshold:	0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
Applicability:	Gasoline, diesel, aviation fuel, fuel oil, solvents, and waste oil.
Capacity:	The maximum tank capacity is 18,000 gallons. The tank being tested must be between 11% and 95% full.
Waiting Time:	Minimum waiting time between product delivery to the tank and test data collection must be 6 hours.
Test Period:	The minimum data collection time must be 3 hours. Test data must be acquired and recorded by a computer. Leak rate is calculated from average of subsets of all collected data. There must be no dispensing or product delivery during the test.
Temperature:	A minimum of 24 inches of product must be present for the temperature probes to operate properly.
Ground Water:	Depth to the water table present in the backfill must be determined, and if it is above the bottom of the tank, the product level in the tank is adjusted to provide minimum of 1 psi net pressure on the bottom of the tank during the test.
Calibration:	Temperature probes and floats must be checked for proper operation prior to each test.
Comments:	<ol style="list-style-type: none"> 1. The equipment was not evaluated using manifolded tanks. 2. This equipment only tests the portion of the tank that contains product. 3. As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).

NDE Environmental Corp.
8906 Wall Street, Suite 306
Austin, TX 78754
Tel: (800) 800-4633

Evaluator: ADA Technologies

Date of Evaluation: 09-09-92

UST Ullage Test - Version ProEco U2

NON-VOLUMETRIC ULLAGE TANK TIGHTNESS TEST METHOD

Certification:	Leak rate of 0.1 gallon per hour with $P_D = 95.24\%$ & $P_{FA} = 0\%$.
Leak Threshold:	Pressure decay trend not to exceed ± 0.016 psi/hr.
Applicability:	Gasoline, diesel, aviation fuel, heavy fuel oils (#2 through #6), and solvents.
Capacity:	Maximum ullage volume is 10,260 gallons.
Waiting Time:	At least 2 hours between the end of adding the product and the start of data collection.
Test Period:	Minimum data collection time must be 30 minutes (after data trend has been established).
Test Pressure:	During the test, a total of 4.0 psi pressure at the bottom of the tank is applied.
Temperature:	Temperature of ullage portion of the tank is monitored during the test. A correction factor is applied to account for temperature changes. The correction factor is not applicable for ullage temperature changes greater than 5°F.
Groundwater:	Depth to the water table present in the backfill must be determined. If it is above the product level, the ullage test pressure is maintained at a minimum of 1.0 psi higher than the pressure exerted by water table.
Comments:	<ul style="list-style-type: none"> - The product filled portion of the tank must be tested using a volumetric underfilled test. - This test method was third-party certified using #2 diesel fuel as the test product. - This test method was not third-party certified with manifolded tanks.

NDE Environmental Corp.
8906 Wall Street, Suite 306
Austin, TX 78754
Tel: (800) 800-4633

Evaluator: ADA Technologies, Inc.

Date of Evaluation: 04-10-92

NON-VOLUMETRIC ULLAGE TANK TIGHTNESS TEST METHOD

- Certification:** Leak rate of 0.1 gallon per hour with $P_0 = 95.2\%$; $P_{FA} = 0\%$.
- Leak Threshold:** Make-up gas flow rate into ullage exceeding 0.275 cubic feet/hour.
- Applicability:** Gasoline, diesel, aviation fuel, heavy fuel oils #4, and solvents.
- Capacity:** Maximum ullage volume is 7,500 gallons.
- Waiting time:** At least 2 hours between the end of adding the product and the start of data collection.
- Test Period:** Data collection time is at least 30 minutes. Test data is acquired and recorded manually.
- Test Pressure:** The pressure in the ullage portion of the tank is increased such that the net pressure at the bottom of the tank (sum of ullage pressure and product head) does not exceed 5.0 psi. It is maintained for a minimum of 5 minutes per 1,000 gallons of ullage. At the conclusion of this stabilization period, the ullage pressure is reduced by 0.5 psi for the remainder of the test.
- Temperature:** Temperature of the ullage must be monitored, and the rate of change of ullage temperature must not exceed manufacturer's tabulated values.
- Groundwater:** Depth to the water table present in the backfill must be determined, and if it is above the product level, the net outward pressure must exceed 1 psi throughout the ullage.
- Comments:**
- The product portion of the tank must be tested using a volumetric underfilled test.
 - This test method was third-party certified using #2 diesel fuels as the test product.
 - This test method was third-party certified using manifolded tanks.

NDE Environmental
8906 Wall Street, Suite 306
Austin, TX 78754
Tel (800) 800-4633

Evaluator: Midwest Research Institute

Date of Evaluation: 12-04-92

NON-VOLUMETRIC ULLAGE TANK TIGHTNESS TEST METHOD

- Certification:** Leak rate of 0.1 gallon per hour with $P_0 = 100\%$ & $P_{FA} = 0\%$.
- Leak Threshold:** A leak is declared if the noise signal detected is different from the baseline. (Baseline is the noise signal before pressure or vacuum is applied to the tank.)
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4 and #6, solvent and waste oil. Since this is an ullage test, it is applicable to virtually any fluid.
- Capacity:** Maximum ullage volume is 16,500 gallons.
- Waiting Time:** There is no waiting time required after product delivery to the tank.
- Test Period:** The data collection time (determination of background noise and a leak) is a few minutes. After the desired pressure has been reached, the tank should be allowed to settle for ten minutes. Test period also depends on background noise at the site and on the size of the leak.
- Test Pressure:** A vacuum blower to produce a vacuum of 1 psi in the ullage portion is used. Or, a nitrogen pressure of 4 psi at the tank bottom is applied.
- Temperature:** Acoustical signal is independent of product temperature.
- Groundwater:** Depth to the water table present in the backfill must be determined. If it is above the product level, a vacuum test should not be used. The pressure test may only be used if the ullage test pressure is maintained at a minimum of 1.0 psi higher than the pressure exerted by the water table. If this requires more than 5 psi at tank bottom, then the ullage test should not be used.
- Comments:**
- This test method was third-party certified using #2 diesel fuel as the test product.
 - During the third-party testing, the microphone was 25 feet away from the leak source.
 - Excess background noise can be a factor in the test result. If background noise is too high, the test is inconclusive.
 - Noise signals are tape recorded (not digitally recorded).
 - This test method was not third-party certified with manifolded tanks.
 - When testing with vacuum, this test method may not be effective in some backfill, because some particles (such as clay) may plug a hole in the tank.
 - If the soil is saturated with product, this test will not detect air or water ingress.

NDE Environmental Corp.
8906 Wall Street
Austin, TX 78754
Tel: (800) 800-4633

Evaluator: Ken Wilcox Associates

Date of Evaluation: 1/15/93

NDE Environmental

Proline Test Series III, Version 1.0

LINE TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gallon per hour with $P_D = 99.0\%$ & $P_{FA} = 0.1\%$.

Leak Threshold: 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4 & #6, solvents, and waste oil.

Specification: System tests fiberglass and steel piping.
The piping system volume must not exceed 41 gallons.
Tests are conducted at 150% of the line operating pressure.
Mechanical line leak detector must be removed from the pipeline system being tested.

Waiting Time: No waiting time between last delivery of the product to the tank and the start of data collection.
Minimum waiting time between last dispensing and testing is one hour.

Test Period: The minimum data collection time for the test must be one hour.
Pipe deflection, vapor pockets, and large temperature differences may produce inconsistent readings, testing to continue until stable conditions are present.
Test data must be acquired and recorded manually.
Manual calculations are performed by the operator on site.

Calibration: Sensors must be calibrated before each test.

NDE Environmental Corp.
8906 Wall Street, Suite 306
Austin, TX 78754
Tel: (800) 800-4633

Evaluator: Midwest Research Institute

Date of Evaluation: 08-30-91

NDE Environmental

PTK-88

LINE TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gallon per hour with $P_D = 99.8\%$ & $P_{FA} = 1.3\%$.

Leak Threshold: 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, fuel oil, solvent, and waste oil.

Specification: System tests fiberglass and steel piping.
The piping system volume must not exceed 40 gal.
Tests are conducted at 150% of the line operating pressure.
The mechanical line leak detector must be removed from the pipeline system being tested.

Waiting Time: There is no minimum waiting period between product delivery and testing.
Minimum waiting period between last dispensing and testing is one hour.

Test Period: The minimum data collection time must be 10 minutes per cycle.
Test data is acquired and recorded manually.
Manual calculations are performed by the operator on site.

Calibration: Sensors must be calibrated before each test.

NDE Environmental Corp.
8906 Wall Street, Suite 306
Austin, TX 78754
Tel: (800) 800-4633

Evaluator: Midwest Research Institute

Date of Evaluation: 2/14/91

DRAFT

O/C Tanks Corporation

O/C TANKS Hydrostatic Precision Tank Test for DWT-Type II Tanks

DOUBLE WALLED TANK TIGHTNESS TEST

Certification: Leak rate of 0.1 gallon per hour with per hour with $P_D=99.9\%$ & $P_{FA}=1.2\%$ without dispensing and with $P_D=95\%$ & $P_{FA}=5.0\%$.

Leak Threshold: 0.05 gallon per hour without dispensing and 0.07 gallon per hour with dispensing (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, and fuel oil #4.

Capacity: The maximum tank capacity is 13,000 gallons.
The tank may be tested from zero to 100% full.
The maximum tank diameter must be 10 feet.

Waiting Time: Minimum waiting time between product delivery and test data collection must be 24 hours.
Minimum waiting time between "topping off" the annular space with liquid and test data collection must be 3 hours.
There must be no dispensing or product delivery during the test waiting time.

Test Period: The minimum data collection time must be 4 hours.
The maximum amount of liquid allowed to withdraw from the tank during the test must be 150 gallons per hour.
A leak is not declared unless the threshold is exceeded in two tests, separated by at least 8 hours which are performed without dispensing and without changes in the water table.

Other Limitations: Volume of trapped vapor not to exceed 20 gallons. The change in barometric pressure must be less than 0.04 psia over the 4-hour test period. The annular space is at least 100% full with either water or antifreeze. If the ground water is above the bottom of the tank, and no product is being dispensed during a test, the total change in ground water elevation during a test must be less than 1.5 inches per hour. If the ground water is below the bottom of the tank or not changing during a test, the total change in product level during a test must be less than 0.75 inches per hour.

O/C Tanks Corporation
Fiberglass Tower
Toledo, OH 43699
Tel: (419) 248-5475

Evaluator: Vista Research

Date of evaluation: 05-15-91

DRAFT

One Plus Corporation

Leak Edge
Models 100-3001, 100-4001

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: product permeable

Test Results:

	Commercial Gasoline	Synthetic Gasoline
Accuracy(%)	100	
100		
Detection time(hr:min:sec)	00:05:41	00:05:14
Fall Time (hr:min:sec)	00:30:39	00:18:36
Lower detection limit(cm)	0.02	0.02

Specificity Results:

Activated: commercial gasoline, n-Hexane, diesel fuel, Jet-A fuel, toluene, synthetic gasoline, xylene(s).

Manufacturer's Specifications:

Operating temperatures: Sensor is -40°C to +74°C; Monitor Module is -20°C to 49°C.

Comments:

EPA and many states require detection of 1/8 inch of product, which is 0.32 cm. This detector is reusable.

One Plus Corporation
1955 Sherman Rd., Suite 100
Northbrook, IL 60062
Tel: (708) 498-0955

Evaluator: Underwriters Laboratories Inc.

Date of evaluation: 12-17-91

7021 Digital Tank Gauge

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.2 gallon per hour with $P_D = 99.96\%$ & $P_{FA} = 0.044\%$.

Leak Threshold: 0.1 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, and solvents.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be 10% to 95% full.

Waiting Time: Minimum waiting time between product delivery and test data collection must be 2 hours.
There must be no dispensing or product delivery during the test waiting time.

Test Period: The minimum data collection time must be 4 hours.
Test data must be acquired and recorded by the 7021 controller.
Leak rate calculated from data determined to be statistically valid.

Temperature: Minimum of 1 resistance temperature detector must be used to determine the average temperature of the stored product.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 0.947 inches.
Minimum detectable water level change is 0.0254 inches.

Calibration: Temperature sensors and probe must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment tests only that portion of the tank which contains product.
As the product level is lowered, the leak rate in a leaking tank decreases (due to lower head pressure).
This equipment was originally manufactured by MagneTek (Patriot's predecessor).
This system is identical to API Ronan's X-76 ETM ATGS.

7021 Digital Tank Gauge

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.1 gallon per hour with $P_D = 95.34\%$ and $P_{FA} = 4.66\%$.

Leak Threshold: 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, and solvents.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be 10% to 95% full.

Waiting Time: Minimum waiting time between product delivery and test data collection must be 8 hours.
There must be no dispensing or product delivery during the test waiting time.

Test Period: The minimum data collection time must be 4 hours.
Test data must be acquired and recorded by the 7021 controller.
Leak rate calculated from data determined to be statistically valid.

Temperature: Minimum of 1 resistance temperature detector must be used to determine the average temperature of the stored substance.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 0.947 inches.
Minimum detectable water level change is 0.0254 inches.

Calibration: Temperature sensors and probes must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment only tests that portion of the tank which contains product.
As the product level is lowered, the leak rate in a leaking tank decreases (due to lower head pressure).
This equipment was originally manufactured by MagneTek (Patriot's predecessor).
This system is identical to API Ronan's X-76 ETM ATGS.

PermAlert

PAL-AT Models AT20C, AT50C, AT40K
AGW Sensor Cable

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative for presence of product
quantitative for location
Sampling frequency: continuous
Operating principle: capacitance change

Test Results:

	Commercial Gasoline		
	1/3 MER**	2/3 MER	MER
	1348 ft.	2644 ft.	3982 ft.
Accuracy (%)	100	100	100
Response time (min)	9.92	6.25	21.28
Recovery time (min)	1.0	1.0	1.0
Product activation height (cm)	2.03	1.13	5.00
Detection length (cm)	116.3	64.8	286.1
Lower Detection Limits:			
Product act. height (cm)	Not det.	Not det.	5.1
Detection length (cm)	Not det.	Not det.	295.6

- * at a flow rate of 0.14 gal/hr in test chamber
- ** MER is Maximum Effective Range, the longest length of sensor cables and/or jumper cables that can be connected to form a leak detection network.

Specificity Results:

Activated: diesel fuel, synthetic fuel, home heating oil #2, water.

Manufacturer's Specifications:

Comments: EPA and many states require detection of 1/8 inch of product, which is 0.32 cm, for ground water monitoring. The test procedures used were those in Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Cable Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991. Evaluation also covered quantitative leak location.

PermAlert
7720 North Lehigh Avenue
Niles, IL 60714-3491
Tel: (708) 966-2190

Evaluator: Carnegie Mellon Research Institute

Date of evaluation: 01-17-92

PermAlert

PAL-AT Models AT20C, AT50C, AT40K
with PHFW Hydrocarbon Probe and Type 1 Sensor

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: product soluble

Test Results:

	Commercial Gasoline	Synthetic Gasoline
Accuracy(%)	100	100
Detection time(min:sec)	00:24	00:09
Fall Time (min:sec)	Not App.	Not App.
Lower detection limit(cm)	0.01	0.01

Specificity Results:

Activated: commercial gasoline, n-Hexane, diesel fuel, Jet-A fuel, toluene, synthetic gasoline, xylene(s).

Manufacturer's Specifications:

Operating temperature range is 0°F to 90°F.

Comments:

EPA and many states require detection of 1/8 inch of product, which is 0.32 cm. This detector is not reusable.

PermAlert
7720 North Lehigh Avenue
Niles, IL 60714-3491
Tel: (708) 966-2190

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 09-15-92

PAL-AT Models AT20C, AT50C, AT40K
with PHFW Hydrocarbon Probe and Type 2 Sensor

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: product soluble

Test Results:

	Commercial Gasoline	Synthetic Gasoline
Accuracy(%)	100	100
Detection time(min:sec)	14:39	08:45
Fall Time (min:sec)	Not App.	Not App.
Lower detection limit(cm)	0.01	0.01

Specificity Results:

Activated: commercial gasoline, n-Hexane, diesel fuel, Jet-A fuel, toluene, synthetic gasoline, xylene(s).

Manufacturer's Specifications:

Operating temperature range is 0°F to 90°F.

Comments:

EPA and many states require detection of 1/8 inch of product, which is 0.32 cm. This detector is not reusable.

PermAlert
7720 North Lehigh Avenue
Niles, IL 60714-3491
Tel: (708) 966-2190

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 9-15-92

PAL-AT Models AT20C, AT50C, AT40K
TFH Hydrocarbon Sensor Cable

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative for presence of product
quantitative for location
Sampling frequency: continuous
Operating principle: capacitance change

Test Results:

	Commercial Gasoline		
	1/3 MER**	2/3 MER	MER
	1368 ft.	2685 ft.	4046 ft.
Accuracy (%)	100	100	100
Response time (min)	3.40	7.48	16.21
Recovery time (min)	>60	>60	>60
Product activation height (cm)	0.65	1.33	3.53
Detection length (cm)	27.7	56.8	150.4
Lower Detection Limits:			
Product act. height (cm)	Not det.	Not det.	3.6
Detection length (cm)	Not det.	Not det.	152.9

- * at a flow rate of 0.16 gal/hr in test chamber
- ** MER is Maximum Effective Range, the longest length of sensor cables and/or jumper cables that can be connected to form a leak detection network.

Specificity Results:

Activated: diesel fuel, synthetic fuel, home heating oil #2
Not activated: water

Manufacturer's Specifications:

Comments: EPA and many states require detection of 1/8 inch of product, which is 0.32 cm, for ground water monitoring. The test procedures used were those in Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Cable Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991. Evaluation also covered quantitative leak location.

PermAlert
7720 North Lehigh Avenue
Niles, IL 60714-3491
Tel: (708) 966-2190

Evaluator: Carnegie Mellon Research Institute

Date of evaluation: February 11, 1992

DRAFT

PermAlert

PAL-AT Models AT20C, AT50C, AT40K
PHL Hydrocarbon Sensor

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: electrical conductivity

Test Results*:

	Commercial
	<u>Gasoline</u>
Accuracy (%)	100
Response time (min)	1.13
Recovery time (min)	8.83
Product activation height (cm)	0.53
Lower Detection Limit (cm)	0.38

* at a flow rate of 0.13 gal/hr in a 4.8 cm diameter test chamber

Specificity Results:

Activated: diesel fuel, synthetic fuel, home heating oil #2
Not Activated: water

Manufacturer's Specifications:

Comments: The test procedures used were those in Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.

PermAlert
7720 North Lehigh Avenue
Niles, IL 60714-3491
Tel: (708) 956-2190

Evaluator: Carnegie Mellon Research Institute

Date of evaluation: February 5, 1992

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PermAlert

TankWatch Models PHM10, PHMS
Combination Hydrocarbon/Water Probe

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: electrical conductivity

Test Results*:

	Commercial	
	<u>Gasoline</u>	<u>Water</u>
Accuracy (%)	100	100
Response time (min)	0.30	1.68
Recovery time (min)	1.97	<1
Product activation height (cm)	0.18	0.80
Lower Detection Limit (cm)	0.56	1.93

* at a flow rate of 0.13 gal/hr in a 4.8 cm diameter test chamber

Specificity Results:

Activated: diesel fuel, synthetic fuel, home heating oil #2

Manufacturer's Specifications:

Comments: The test procedures used were those in Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.

PermAlert
7720 North Lehigh Avenue
Niles, IL 60714-3491
Tel: (708) 956-2190

Evaluator: Carnegie Mellon Research Institute

Date of evaluation: June 16, 1992

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DRAFT

DRAFT

PermAlert

TankWatch Models PHM10, PHMS
Hydrocarbon Probe

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: electrical conductivity

Test Results:

	Commercial
	<u>Gasoline</u>
Accuracy (%)	100
Response time (min)	0.25
Recovery time (min)	2.33
Product activation height (cm)	0.17
Lower Detection Limit (cm)	0.38

* at a flow rate of 0.14 gal/hr in a 4.8 cm diameter test chamber

Specificity Results:

Activated: diesel fuel, synthetic fuel, home heating oil #2
Not Activated: water

Manufacturer's Specifications:

Comments: The test procedures used were those in Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.

PermAlert
7720 North Lehigh Avenue
Niles, IL 60714-3491
Tel: (708) 966-2190

Evaluator: Carnegie Mellon Research Institute

Date of evaluation: June 16, 1992

DRAFT

Petro Vend, Inc.

SiteSentinel System
30-3206, -3207, -3210 Sensors

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: product permeable

Test Results:

	Commercial	Synthetic
	<u>Gasoline</u>	<u>Gasoline</u>
Accuracy (%)	100	100
Detection time(hr:min:sec)	00:01:41	00:05:14
Fail Time (hr:min:sec)	07:28:44	00:18:36
Lower detection limit(cm)	0.02	0.02

Specificity Results:

Activated: commercial gasoline, n-Hexane, diesel fuel, Jet-A fuel, toluene, synthetic gasoline, xylene(s).

Manufacturer's Specifications:

Conductive polymer.

Comments:

EPA and many states require detection of 1/8 inch of product, which is 0.32 cm. This detector is reusable. The third party evaluators identified these sensors as identical to One Plus Corporation's Models 100-3001 and 100-4001 Leak Edge Hydrocarbon Leak Monitor System. The evaluation was abbreviated and used some data from the One Plus system evaluation.

Petro Vend, Inc.
6900 Santa Fe Drive
Hodgkins, IL 60525
Tel: (708) 485-4200

Evaluator: Underwriters Laboratories, Inc.

Date of Evaluation: 12-10-92

DRAFT

Petro Vend, Inc.

Petrosentry IV, Petrosentry VIII, SiteSentinel
Liquid Sensor

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: thermal conductivity

Test Results*:

	Commercial Gasoline
Accuracy (%)	100
Response time (min)	0.51
Recovery time (min)	<1
Product activation height (cm)	0.35
Lower Detection Limit (cm)	0.76

- * at a flow rate of 0.14 gal/hr in a 4.8 cm diameter test chamber

Specificity Results:

Activated: diesel fuel, synthetic fuel, home heating oil #2, water

Manufacturer's Specifications:

Comments: The test procedures used were those in Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.

Petro Vend, Inc.
6900 Santa Fe Dr.
Hodgkins, IL 60525-8909
Tel: (708) 485-4200

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 10-15-92

Petro Vend, Inc.

DRAFT

Petrosentry IV, Petrosentry VIII, SiteSentinel
Universal Reservoir Sensor

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: float switch

Test Results*:

	50 wt% Ethylene glycol in water		30 wt% Calcium chloride in water	
	Up	Down	Up	Down
Accuracy (%)	100	100	100	100
Response time (min)	19.62	16.86	17.77	15.91
Recovery time (min)	<1	<1	<1	<1
Product activation height (cm)	20.9	5.90	20.5	5.95

- * at a flow rate of 0.21 gal/hr in test chamber

Specificity Results:

Not applicable

Manufacturer's Specifications:

Comments:

This point sensor is intended to monitor the level of either ethylene glycol or calcium chloride solutions in the interstitial or annular space of a double-walled tank, by triggering an alarm if any significant gain or loss of solution occurs. Evaluation was performed using procedures from Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991, modified to accommodate the intended purpose.

Petro Vend, Inc.
6900 Santa Fe Dr.
Hodgkins, IL 60525-8909
Tel: (708) 485-4200

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 10-15-92

DRAFT

Petro Vend, Inc.

Petrosentry IV, Petrosentry VIII, SiteSentinel
Universal Sump Sensor

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: float switch

Test Results:

	Commercial
	<u>Gasoline</u>
Accuracy (%)	100
Response time (min)	8.32
Recovery time (min)	<1
Product activation height (cm)	3.37
Lower Detection Limit (cm)	3.97

* at a flow rate of 0.20 gal/hr in a 7.8 cm diameter test chamber

Specificity Results:

Activated: diesel fuel, synthetic fuel, home heating oil #2, water

Manufacturer's Specifications:

Comments: The test procedures used were those in Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.

Petro Vend, Inc.
6900 Santa Fe Dr.
Hodgkins, IL 60525-9909
Tel: (708) 485-4200

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 10-15-92

DRAFT

Petro Vend, Inc.

Petrosentry TLD III

VAPOR PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: metal oxide semiconductor

Test Results:

	<u>Benzene</u>	<u>2-Methylbutane</u>
Accuracy (%)	100	100
Detection Time (min:sec)	00:05	00:16
Fall Time (min:sec)	04:12	00:42
Lower Detection Limit (ppm)	12.5	12.5

Specificity Results:

Activated: Benzene, n-Butane, n-Hexane, Isobutane, 2-Methylpentane, Toluene

Manufacturer's Specifications:

Maximum Wire Distance: 500 ft using 18 AWG

Comments:

Petro Vend, Inc.
6900 Santa Fe Drive
Hodgkins, IL 60525-9909
Tel: (708) 485-4200

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 03-26-91

DRAFT

Petro Vend, Inc.

SiteSentinel
Smart Module and Vapor Sensor

VAPOR PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: metal oxide semiconductor

Test Results:

	Commercial Gasoline	Synthetic Gasoline	JP-4
Accuracy* (%):	100	100	100
Detection Time* (min:sec):	00:05	00:07	00:10
Fall Time* (min:sec):	06:30	03:35	04:26
Lower Detection Limit (ppm):	10	10	10

* for tests conducted with 1000 ppm of test gas

Specificity Results:

Activated: Commercial gasoline, Synthetic gasoline, JP-4 Jet Fuel, n-Hexane, Toluene, Xylene(s)

Manufacturer's Specifications:

Comments:

The test procedures used were those in Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods," June 29, 1990.

Petro Vend, Inc.
6900 Santa Fe Dr.
Hodgkine, IL 60525-9909
Tel: (708) 485-4200

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 04-16-92

DRAFT

Pneumercator Company, Inc.

LDE 700, LDE 740, LDE 9000
Sensor Probe Models 9-901, 9-902, 9-903

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: capacitance

Test Results:

	Commercial Gasoline	Synthetic Gasoline
Accuracy(%)	100	100
Detection time(min:sec)	<00:01	<00:01
Fall Time (hr:min:sec)	Manual reset	Manual reset
Lower detection limit(cm):		
9-901	0.32	0.36
9-902	0.36	0.34
9-903	0.76	0.74

Specificity Results:

Activated: commercial gasoline, n-Hexane, diesel fuel, Jet-A fuel, toluene, synthetic gasoline, xylene(s), water.

Manufacturer's Specifications:

Comments:

EPA and many states require detection of 1/8 inch of product, which is 0.32 cm, for ground water monitoring. This system is listed as interstitial. Evaluation followed a combination of EPA's "Standard Test Procedures for Evaluating Leak Detection Methods: Liquid-Phase Out-of-Tank Product Detectors" and EPA's "Standard Test Procedures for Evaluating Leak Detection Methods: Nonvolumetric Tank Tightness Testing Methods." This detector is reusable.

Pneumercator Company, Inc.
120 Finn Court
Farmingdale, NY 11735
Tel: (516) 293-8450

Evaluator: Ken Wilcox Associates

Date of Evaluation: 12-14-93

DRAFT

Raychem Corporation

TraceTek Alarm and Locator Modules
TT502 Fuel Sensing Cable

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative for presence of product
quantitative for location

Sampling frequency: continuous

Operating principle: electrical conductivity

Test Results:

	Commercial Gasoline		
	1/3 MER**	2/3 MER	MER
Accuracy (%)	334 m	665 m	995 m
Response time (min)	100	100	100
Recovery time (min)	22.11	17.13	19.42
Product activation height (cm)	Not app.	Not app.	Not app.
Detection length (cm)	1.53	1.53	1.53
Lower Detection Limits:	61	61	61
Product act. height (cm)	Not det.	Not det.	0.77
Detection length (cm)	Not det.	Not det.	10

- * at a flow rate of 0.17 gal/hr in test chamber
- ** MER is Maximum Effective Range, the longest length of sensor cables and/or jumper cables that can be connected to form a leak detection network.

Specificity Results:

Activated: diesel fuel, synthetic fuel, home heating oil #2

Not activated: water

Manufacturer's Specifications:

Comments: EPA and many states require detection of 1/8 inch of product, which is 0.32 cm, for ground water monitoring. The test procedures used were those in Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Cable Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991. Evaluation also covered quantitative leak location.

Raychem Corporation
300 Constitution Dr.
Menlo Park, CA 94025-1164
Tel: (415) 361-3333

Evaluator: Carnegie Mellon Research Institute

Date of evaluation: May 15, 1992

DRAFT

Schuster Instruments

Tel-A-Leak 1 (Overfilled Test)

VOLUMETRIC TANK TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gallon per hour with $P_D = 99.86\%$ & $P_{FA} = 0.14\%$.

Leak Threshold: 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4, solvents and waste oil.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be 100% full.

Waiting Time: Minimum waiting time between product delivery to the tank and test data collection must be 6 hours.
Minimum waiting time between "topping off" and test data collection must be 1 hour.

Test Period: The minimum data collection time must be 1 hour.
Test data is acquired and recorded manually and by a computer.
Leak rate calculated from average of the last 10 consecutive 6 minute readings.
There must be no dispensing or product delivery during the test.

Temperature: A minimum of 10 temperature sensors must be used to determine the average temperature of the stored product.

Ground Water: Depth to the water table present in the backfill must be determined, and if it is above the bottom of the tank, product level must be adjusted to provide 2-4 psi net pressure on the bottom of the tank during the test.

Calibration: Sensors must be checked and calibrated annually.

Comments: This system was not evaluated for use in manifolded tanks.

Schuster Instruments
211 East Grove Street
Kawkawlin, MI 48631
Tel: (517) 684-6638

Evaluator: W. A. Kibbe & Associates

Date of Evaluation: 11-26-90

DRAFT

Simmons Sirvey Corporation

SIR 5.7 (quantitative)

STATISTICAL INVENTORY RECONCILIATION TEST METHOD

Certification: Method is certified to detect a 0.1 gph leak rate with $P_D = 99.0\%$ and $P_{FA} = 1.0\%$.

Leak Threshold: A leak is declared when leak rate exceeds 0.05 gallon per hour.

Applicability: Motor vehicle fuels.

Tank Capacity: Maximum tank capacity shall not exceed 18,000 gallons.

Data Requirement: Minimum of 30 days of product level and flow through data.

Comments: All 41 data sets were analyzed with conclusive results.

The median monthly throughput for tanks used in the evaluation was 7,000 gallons.

Leak rates ranging from 0.05 to 0.2 gph were used in the evaluation.

This evaluation did not include data from manifolded tanks.

Data sets used in this evaluation were supplied by the evaluator.

Simmons Sirvey Corporation
9550 Forest Lane, Ste. 720
Dallas, TX 75243-5934
Tel: (800) 848-8378

Evaluator: S.S.G. Associates

Date of Evaluation: 12-15-92

DRAFT

S.I.R. International, Inc.

Mitchell's SIR Program v.2.6 12-13-91 (Quantitative)

STATISTICAL INVENTORY RECONCILIATION TEST METHOD

Certification: Method is certified to detect a 0.1 gph leak rate with $P_D = 98\%$ and $P_{FA} = 2\%$.

Leak Threshold: A leak is declared when leak rate exceeds 0.05 gallon per hour.

Applicability: Gasoline, diesel, aviation fuel, and fuel oil #4.

Tank Capacity: Maximum UST capacity shall not exceed 18,000 gallons.

Data Requirement: Minimum of 32 days of product level and flow through data.

Comments: Of the 41 data sets presented for evaluation, only 24 "best" analyses were returned. 17 data sets were not analyzed.

The median monthly throughput for tanks used in this evaluation was 6313 gallons.

Leak rates of 0.049 to 0.21 gph were used in the evaluation.

Data sets used in this evaluation were supplied by the evaluator.

This evaluation did not include data from manifolded tanks.

S.I.R. International, Inc.
2505 N. Moore Ave.
Moore, OK 73160
(800) 793-1900

Evaluator: Ken Wilcox Associates

Date of Evaluation 01-27-92

DRAFT

Sir Phoenix, Inc.

SIR MONITOR (quantitative)

STATISTICAL INVENTORY RECONCILIATION TEST METHOD

Certification: Method is certified to detect a 0.1 gph leak rate with $P_D = 99.0\%$ and $P_{FA} = 1\%$.

Leak Threshold: A leak is declared when leak rate exceeds 0.05 gallon per hour.

Applicability: Gasoline, diesel, aviation fuel, and fuel oil #4.

Tank Capacity: Maximum tank capacity shall not exceed 18,000 gallons.

Data Requirement: Vendor requires 90 days of product level and flow through data before making the first evaluation.

Comments: Of the 41 data sets presented for evaluation, 5 were inconclusive.

The median monthly throughput for tanks used in the evaluation was 14,600 gallons.

Leak rates of 0.05, 0.1, and 0.2 gph were used in this evaluation.

Data sets used in this evaluation were supplied by the vendor.

This evaluation did not include data from manifolded tanks.

Sir Phoenix, Inc.
P.O. Box 588
Lawrenceburg, TN 38464
(615) 762-3300

Evaluator: Nathan Adams, Middle TN State Univ.

Date of Evaluation 11-05-92

Soiltest, Inc.

Soiltest Airway Tank Integrity Tester, S-3 (Overfilled Test)

VOLUMETRIC TANK TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gallon per hour with $P_D = 99\%$ and $P_{FA} = 1\%$.

Leak Threshold: 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be 100% full.

Waiting Time: Minimum waiting time between product delivery to the tank and test data collection must be 10 hours.
Minimum waiting time between "topping off" and test data collection must be 2 hours.

Test Period: The minimum data collection time must be 1.5 hours.
Test data is acquired and recorded manually and by a strip chart recorder.
Leak rate is calculated from data of last 1.5 hours of test period.
There must be no dispensing or product delivery during the test.

Temperature: A minimum of 3 thermistors must be used to determine the average temperature of the stored hazardous substance.

Ground Water: Depth to the water table present in the backfill must be determined, and if it is above the bottom of the tank, product level must be adjusted to provide 2-4 psi net pressure on the bottom of the tank during the test.

Calibration: Level sensors must be calibrated before each test.
Temperature sensor must be calibrated annually.

Comments: 1. This equipment was not evaluated using manifolded tanks.

Soiltest, Inc.
88 Albrecht Drive
P. O. Box 8004
Lake Bluff, IL 60044-8004
Tel: (800) 323-1242

Evaluator: Law Engineering Industrial Services

Date of Evaluation: 11-28-90

Store Vision Version E.2 (qualitative)

STATISTICAL INVENTORY RECONCILIATION TEST METHOD

Certification: Method is certified to detect a 0.2 gph leak with a $P_D=95.7\%$ and $P_{FA}=0\%$.

Leak Threshold: A leak is declared when leak rate exceeds 0.0834 gallons per hour.

Applicability: Gasoline, diesel, aviation fuel, and fuel oil #4.

Tank Capacity: Maximum tank capacity may not exceed 12,000 gallons.

Data Requirement: Minimum of 29 days of product level and flow through data are required.

Comments: Of the 120 data sets presented for evaluation, 32 were inconclusive.

The median monthly throughput for tanks used in this evaluation was 8,097 gallons.

A single leak rate of 0.2 gph was used in this evaluation.

This evaluation did not include data from manifolded tanks.

Data sets used in this evaluation were supplied by the evaluator.

Syscorp, Inc.
1513 Huffman Road, Suite 202
Birmingham, AL 35215
(205) 853-0004

Evaluator: Midwest Research Institute

Date of Evaluation: 09-30-93

Automated Precision Tank Testing System (APTT System)
R-2 Overfilled Test

VOLUMETRIC TANK TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gallon per hour with $P_D=99\%$ & $P_{FA}=1\%$.

Leak Threshold: 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4, fuel oil #6, solvents, waste oil, and other compatible products.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be 100% full.

Waiting Time: Minimum waiting time between product delivery and test data collection must be 10.5 hours.
Minimum waiting time between "topping off" and test data collection must be 2.5 hours.
There must be no dispensing or product delivery during the test waiting time.

Test Period: The minimum data collection time must be 1 hour.
Test data must be acquired and recorded manually for level measurement and by computer for temperature measurement.
Leak rate is calculated from the 1 hour test period.

Temperature: A total of 10 thermistors is used to determine the average temperature of the stored product.

Ground Water: Groundwater presence is checked to a depth of 5 feet and test is performed at product level of 66 inches above grade to ensure a minimum 1 psi pressure at bottom of tank.

Calibration: Temperature and level sensors are calibrated annually.

Comments: This system was not evaluated using manifolded tanks.

Tank Automation, Inc.
P.O. Box 1395
Wall, NJ 07719
Tel: (908) 280-2233

Evaluator: Wildwood Engineering

Date of Evaluation: 11-14-90

VacuTect

NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD

- Certification:** Leak rate of 0.1 gallon per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.
- Leak Threshold:** Air or water incursion (a leak is declared if any air or water incursion is detected).
- Applicability:** Gasoline, diesel, aviation fuel, fuel oil #4, and waste oil.
- Capacity:** The maximum tank capacity is 75,000 gallons.
The tank must be more than 60% full.
- Test Period:** The minimum data collection time must be 2 hours if no water is detected prior to or at the conclusion of the test.
If water is detected prior to or at the conclusion of the test, the minimum test time is 4 hours. The actual test time must be calculated based on the tank size, amount of water present in the tank prior to the test, tank tilt, type of the water sensor and its location.
Test data must be acquired and recorded by computer and audio cassette tape.
An inclinometer must be used to determine and record tank tilt.
- Water Sensor:** A water sensor (at the lowest point of the tank) must be used to detect water incursion. The type of water sensor, the minimum detectable water level, and minimum detectable water level change for the sensor must be documented.
- Ground Water:** Depth to the water table present in the backfill must be determined, and if it is above the bottom of the tank, test time must be extended to allow sufficient time to detect 0.1 gph incursion of water into the tank.
- Vacuum:** The minimum vacuum at the bottom of the tank must be - 0.5 psi.
- Comment:**
- This test method may not be effective in some backfill because some backfill (such as clay) may plug a hole in the tank.
 - This test method was not third-party certified using manifolded tanks.
 - If the soil is saturated with product this test method may not detect air or water incursion. A well point in the backfill may help identify presence of this condition.
 - During the third-party certification JP-4 was used.

Tanknology Corporation
5255 Hollister
Houston, TX 77040
Tel: (800) 888-8563

Evaluator: Ken Wilcox Associates

Date of Evaluation: 09-08-92

VacuTect Oil Tank System

NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD

- Certification:** Leak rate of 0.1 gallon per hour with $P_D = 97.6\%$ & $P_{FA} = 0\%$.
- Leak Threshold:** Air or water incursion (a leak is declared if any air or water incursion is detected).
- Applicability:** Waste oil.
- Capacity:** The maximum tank capacity is 1,500 gallons.
The tank must be more than 5% full.
- Test Period:** The minimum data collection time must be 2 hours if no water is detected prior to or at the conclusion of the test.
If water is detected prior to or at the conclusion of a test, the minimum test time is 4 hours. The actual test time must be determined based on the tank size, amount of water present in the tank, tank tilt, type of the water sensor and its location.
Test data must be acquired and recorded by computer and audio cassette tape.
An inclinometer must be used to determine and record tank tilt.
- Water Sensor:** A water sensor (at the lowest point of the tank) must be used to detect water incursion. The type of water sensor, the minimum detectable water level, and minimum detectable water level change for the sensor must be recorded in the test report.
- Ground Water:** Depth to the water table present in the backfill must be determined, and if it is above the bottom of the tank, test time must be extended to allow sufficient time to detect 0.1 gph incursion of water into the tank.
- Vacuum:** The minimum vacuum at the bottom of the tank must be at 0.5 psi below the atmospheric pressure.
- Comment:**
- This test method may not be effective in some backfill because some backfill (such as clay) may plug a hole in the tank.
 - This test method was not third-party certified using manifolded tanks.
 - If the soil is saturated with product this test method may not detect air or water incursion. A well point in the backfill may help identify presence of this condition.
 - During the third-party certification Fuel oil #4 was used.

Tanknology Corporation
5255 Hollister
Houston, TX 77040
Tel: (800) 888-8563

Evaluator: Ken Wilcox Associates

Date of Evaluation: 10-28-91

DRAFT

Tanknology Corporation International

TLD-1

LINE TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gallon per hour with $P_D=99.5\%$ and $P_{FA}=0.5\%$.

Leak Threshold: 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, and aviation fuel.

Specification: System tests fiberglass and steel piping.
The piping system volume must not exceed 50 gallons.
Tests are conducted at 150% of the line operating pressure.
Mechanical line leak detector must be removed from the pipeline system being tested.

Waiting Time: Testing may begin immediately after the test equipment is installed in the line. Test may not be ended until the pass/fail criteria set by the manufacturer has been met.

Test Period: The data collection time for the test is 30 minutes to 6 hours.
Pipe deflection, vapor pockets, and large temperature differences may produce inconsistent readings, testing to continue until stable conditions are present.
Test data is acquired and recorded manually.

Tanknology Corporation
5255 Hollister
Houston, TX 77040
Tel: 1-800-888-8563

Evaluator: Ken Wilcox Associates

Date of Evaluation: 12/29/91

DRAFT

Tidel Engineering, Inc.

Tidel Environmental Monitoring System, EMS 2000, 3000, & 3500 Series
Probes #401-0009 & #401-0010

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.2 gallon per hour with $P_D=96.2\%$ & $P_{FA}=3\%$.

Leak Threshold: 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, fuel oil, and solvents.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must contain at least 15 inches of product.

Waiting Time: Minimum waiting time between product delivery to the tank and test data collection must be 2 hours.

Test Period: The minimum data collection time must be 6 hours.
Test data is acquired and recorded by the microprocessor contained within the EMS console.
There must be no dispensing or product delivery during the test.

Temperature: A minimum of five temperature sensors must be used to determine the average temperature of the stored substance.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 1.48 inches.
Minimum detectable water level change is 0.035 inches.

Calibration: Temperature sensors and ultrasonic probe must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment only tests the portion of the tank that contains product.
As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).
EMS 2000 and 3000 Series are no longer manufactured by Tidel.

Tidel Engineering
2815 East Beltline Road
Carrollton, TX 75006
Tel: (214) 416-8222

Evaluator: Ken Wilcox Associates

Date of Evaluation: 06-07-93

Tidel Engineering, Inc.

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Tidel Environmental Monitoring System, EMS 2000, 3000, & 3500 Series
Probes #401-0021 & #401-0022

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.2 gallon per hour with $P_D = 99.91\%$ and $P_{FA} = 0.09\%$.

Leak Threshold: 0.1 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, fuel oil, and solvents.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be at least 15 inches full.

Waiting Time: Minimum waiting time between product delivery to the tank and test data collection must be 2 hours.

Test Period: The minimum data collection time must be 6 hours.
Test data is acquired and recorded by the microprocessor contained within the EMS console.
There must be no dispensing or product delivery during the test.

Temperature: A minimum of 5 temperature sensors must be used to determine the average temperature of the stored substance.

Water Sensor: A water sensor is used to detect water incursion.
Minimum water level detectable in the tank is 1.48 inches.
Minimum detectable water level change is 0.035 inches.

Calibration: Temperature sensors and ultrasonic probe must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment only tests that portion of the tank that contains product.
As the product level is lowered, the leak rate in a leaking tank decreases (due to lower head pressure).
EMS 2000 & 3000 Series are no longer manufactured by Tidel.

Tidel Engineering, Inc.
2615 East Beltline Road
Cerroilton, TX 75006
Tel: (214) 416-8222

Evaluator: Ken Wilcox Associates

Date of Evaluation: 06-07-93

DRAFT

Tidel Engineering

EMS-3500
With Monitoring Well Probes Part 301-0641

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: Conductivity via resistor ladder network

Test Results:

	Commercial Gasoline	Synthetic Gasoline
Accuracy (%)	100	100
Detection time(min:sec)	00:04	00:07
Fall time(min:sec)	<01:00	<01:00
Lower detection limit (cm)	0.32	0.32

Specificity Results:

Activated(100%): commercial gasoline, n-hexane, diesel fuel, Jet-A fuel, toluene, JP-4 jet fuel, toluene, synthetic gasoline, xylene(s).

Manufacturer's Specifications:

Comments:

EPA and many states require detection of 1/8 inch of product, which is 0.32 cm.

Tidel Engineering
2815 East BeltLine Road
Carrollton, TX 75006
Tel: (800) 678-7577

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 02-02-93

DRAFT

Tidel Engineering

EMS-3500
With Sheen Probes Part 301-0687

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: electrical conductivity/hydrocarbon sensitive polymer

Test Results:

	Commercial Gasoline	Synthetic Gasoline
Accuracy (%)	100	100
Detection time(min:sec)	07:45	03:35
Fall time(min:sec)	18:01	16:57
Lower detection limit (cm)	0.02	0.04

Specificity Results:

Activated(100%): commercial gasoline, n-hexane, diesel fuel, Jet-A fuel, toluene, JP-4 jet fuel, synthetic gasoline, xylene(s).

Manufacturer's Specifications:

Comments:

EPA and many states require detection of 1/8 inch of product, which is 0.32 cm.

Tidel Engineering
2815 East BeltLine Road
Carrollton, TX 75006
Tel: (800) 678-7577

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 01-31-93

DRAFT

Tidel Engineering

EMS-3500

Tidel Detector No. 301-0762

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
 Sampling frequency: continuous
 Operating principle: electrical conductivity / hydrocarbon sensitive polymer

Test Results:

	Commercial Gasoline	Synthetic Gasoline
Accuracy (%)	100	100
Detection time (min:sec)	9:31	7:05
Fall Time (min:sec)	55:42	17:04
Lower detection limit(cm)	0.04	0.08

Specificity Results:

Activated: commercial gasoline, n-Hexane, diesel fuel, Jet-A fuel, toluene, synthetic gasoline, xylene(s).

Manufacturer's Specifications:

Ground water probe used to detect free floating hydrocarbons in monitoring wells.

Comments: EPA and many states require detection of 1/8 inch of product, which is 0.32 cm.

Tidel Engineering
 2615 East Belt Line Road
 Carrollton, TX 75006
 Tel: (800) 678-7577

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 03-18-93

DRAFT

Tidel Engineering

Tidel Detector No. 301-0324-001 and 301-0325-001

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
 Sampling frequency: continuous
 Operating principle: electrical conductivity

Test Results:

	Commercial Gasoline	Synthetic Gasoline	Jet Fuel (JP-4)
Accuracy (%)	100	100	100
Detection time(sec)	2	2	1
Fall Time (sec)	1	2	2
Lower detection limit(cm)	0.16-0.32	0.16-0.32	0.16-0.32

Specificity Results:

Activated: commercial gasoline, n-Hexane, diesel fuel, Jet-A fuel, toluene, JP-4 jet fuel, synthetic gasoline, xylene(s).

Manufacturer's Specifications:

Detector No. 301-0324-001

Application: Liquid sensor, water, used in 4" monitoring well
 Sensor: Magnetism and conductivity pins
 Detection Range: 1/8" floating product on ground water or 1.5" free product

Detector No. 301-0325-001

Application: Liquid sensor, water or hydrocarbon used in reservoir, sump or piping trench
 Sensor: Magnetism and conductivity pins
 Detection Range: 1/8" floating product on ground water or 1.5" free product

Comments: EPA and many states require detection of 1/8 inch of product, which is 0.32 cm. Evaluation performed on equivalent Pollert detectors.

Tidel Engineering
 2615 East Belt Line Road
 Carrollton, TX 75006
 Tel: (800) 678-7577

Evaluator: Radian Corporation

Date of Evaluation: 07/08/91

DRAFT

Tidel Engineering

Tidel Detector No. 301-0326-001 and 301-0326-002

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
 Sampling frequency: continuous
 Operating principle: electrical conductivity

Test Results:

	Commercial Gasoline	Synthetic Gasoline	Jet Fuel (JP-4)
Accuracy (%)	100	100	100
Detection time(sec)	4	7	2
Fall time (sec)	3	4	4
Lower detection limit(cm)	0.08-0.32	0.08-0.32	0.08-0.32

Specificity Results:

Activated: commercial gasoline, toluene, n-hexane, diesel fuel, jet-A fuel, JP-4 jet fuel, synthetic gasoline, xylene(s).

Manufacturer's Specifications:

Detector No. 301-0326-001

Application: Liquid sensor, water, used in 2" monitoring well
 Sensor: Magnetism and conductivity pins
 Detection Range: 1/8" floating product on ground water or 2.5" free product

Detector No. 301-0326-002

Application: Liquid sensor, water, used in annulus of double wall steel tanks
 Sensor: Magnetism and conductivity pins
 Detection Range: 1/8" floating product on ground water or 2.5" free product

Comments: EPA and many states require detection of 1/8 inch of product, which is 0.32 cm. Evaluation performed on equivalent Pollulert detectors.

Tidel Engineering
 2615 East Belt Line Road
 Carrollton, TX 75006
 Tel: (800) 678-7577

Evaluator: Radian Corporation

Date of Evaluation: 07/08/91

DRAFT

Tidel Engineering

EMS-3500
 Containment Sump Probes Part No. 301-0642

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
 Sampling frequency: continuous
 Operating principle: magnetic switch / float & hydrocarbon sensitive polymer

Test Results:

	Commercial Gasoline	Water	
		Low	High
Accuracy (%)	100	100	100
Response time (min)	6.39	4.76	4.12**
Recovery time (min)	>60	<1	<1
Product activation height (cm)	2.27	4.31	19.22
Lower Detection Limit (cm)	2.32	4.31	Not App.

* at a flow rate of 0.89 gal/hr in test chamber of diameter 12.6 cm.

** larger test chamber and flow rate of 1.51 gal/hr.

Specificity Results:

Activated at 2.27 cm height:
 diesel fuel, synthetic fuel, home heating oil #2.

Manufacturer's Specifications:

Comments: The test procedures used were those in Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991. In addition, the probe was tested to determine its capability of detection hydrocarbons floating on water. A Lower Detection Limit thickness of 0.04 cm was detected on average in 16 min 41 sec, with the recovery time averaging 12 min 55 sec.

Tidel Engineering
 2615 East Belt Line Road
 Carrollton, TX 75006
 Tel: (800) 678-7577

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 02-17-93

DRAFT

Tidel Engineering

EMS-3500

Liquid Discriminatory Probes Part 301-0635

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
 Sampling frequency: continuous
 Operating principle: electrical conductivity / hydrocarbon sensitive polymer

Test Results*:

	Commercial Gasoline	Water
Accuracy (%)	100	100
Response time (min)	3.59	0.96
Recovery time (min)	13.18	<1
Product activation height (cm)	1.76	0.49
Lower detection limit	4.19	1.52

* at a flow rate of 0.04 gal/hr in a 2.54 cm diameter test chamber

Specificity Results:

Activated: diesel fuel (at liquid height of 1.78 cm), synthetic fuel (at 2.30 cm), home heating oil #2 (at 2.30 cm).

Manufacturer's Specifications:

Comments: The test procedures used were those in Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.

Tidel Engineering
 2615 East Belt Line Road
 Carrollton, TX 75006
 Tel: (800) 678-7577

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 01-29-93

DRAFT

Tidel Engineering

EMS-3500

Tidel Detector No. 301-0752-001

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
 Sampling frequency: continuous
 Operating principle: float switch

Test Results*:

	50 wt% Ethylene glycol in water		30 wt% Calcium chloride in water	
	Up	Down	Up	Down
Accuracy (%)	100	100	100	100
Response time (min)	21.91	30.10	22.27	31.08
Recovery time (min)	<1	<1	<1	<1
Product activation height (cm)	28.92	2.75	28.82	2.48

* at a flow rate of 0.26 gal/hr in test chamber

Specificity Results:

Not applicable

Manufacturer's Specifications:

Comments:

This point sensor is intended to monitor the level of either ethylene glycol or calcium chloride solutions in the interstitial or annular space of a double-walled tank, by triggering an alarm if any significant gain or loss of solution occurs. Evaluation was performed using procedures from Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991; modified to accommodate the intended purpose.

Tidel Engineering
 2615 East Belt Line Road
 Carrollton, TX 75006
 Tel: (800) 678-7577

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 04-20-93

DRAFT

Tidel Engineering

EMS-3000
301-0328-001, 301-0330-001

VAPOR PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: adsistor

Test Results:

	Commercial Gasoline	Synthetic Gasoline	JP-4
Accuracy (%):	100	100	100
Detection Time (sec):	91	65	86
Fall Time (min:sec):	5:39	4:23	9:38
Lower Detection Limit (ppm):	10 to 100	10 to 500	10 to 50

Specificity Results:

Activated: commercial gasoline, JP-4 jet fuel, synthetic gasoline, toluene, xylene(s)
Not activated: n-Hexane

Manufacturer's Specifications:

Comments: The test procedures used were those in Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods," June 29, 1990.

Tidel Engineering
2615 East Belt Line Road
Carrollton, TX 75008
Tel: (800) 678-7577

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 03-18-93

DRAFT

Tidel Engineering

EMS-3500
Vapor Sensor Probe Part No. 301-0634

VAPOR PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: adsistor

Test Results:

	Commercial Gasoline	Synthetic Gasoline	JP-4
Accuracy* (%):	100	100	100
Detection Time* (min:sec):	2:46	1:41	1:50
Fall Time* (hr:min:sec):	> 1:00:00**	> 1:00:00**	> 1:00:00**
Lower Detection Limit (ppm):	100	500	100

* For tests conducted with 1000 ppm of test gas.

** The vapor sensor probe was recalibrated when it did not recover after 1 hour, from exposure to test vapors.

Specificity Results:

Activated: commercial gasoline, JP-4 jet fuel, synthetic gasoline, n-hexane, toluene, xylene(s)

Manufacturer's Specifications:

Vapor sensor probe for use in normally dry monitoring wells to detect hydrocarbon vapors. Can be used in monitoring wells up to 20 feet deep. The probe will alarm if it comes in contact with water and must be removed immediately to prevent damage to the probe.

Comments: Evaluation performed on equivalent Pollutert detectors. The test procedures used were those in Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods," June 29, 1990.

Tidel Engineering
2615 East Belt Line Road
Carrollton, TX 75008
Tel: (800) 678-7577

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 03-18-93

Tokheim Corporation

Tokheim Pressure Monitor, Models PM 101 and 585A-PM

AUTOMATIC MECHANICAL LINE LEAK DETECTOR

Certification:	Leak rate of 3.0 gallons per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.
Leak Threshold:	2.25 gallons per hour (a leak is declared if the output of the measurement system exceeds this threshold).
Applicability:	Gasoline, diesel, and alcohols.
Specification:	System is installed on pressurized fiberglass and steel piping. The piping system volume must not exceed 78 gallons. Tests are conducted at 150% of the line operating pressure.
Waiting Time:	There is no waiting period between product delivery and testing. There is no waiting period between last dispensing and testing.
Test Period:	Minimum test time (response time) must be 4 seconds.
System Features:	This system is permanently installed on the piping and automatically tests the line. It uses a preset threshold and a single test to determine whether the piping is leaking. If a leak is detected, this system restricts fuel flow to dispenser.
Calibration:	The equipment must be checked and calibrated semi-annually in accordance with manufacturer's instructions.
Comments:	Tokheim Corporation no longer manufactures this system.

Tokheim Corporation
10501 Corporate Drive
Fort Wayne, IN 46801-0360
Tel: (219) 423-2552

Evaluator: Vista Research

Date of Evaluation: 11/2/90

Tracer Research Corporation

Tracer Tight

NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD

Certification:	Leak rate of 0.1 gallon per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.
Leak Threshold:	Detection of tracer chemical.
Applicability:	All fluid petroleum products and any other fluid with which the tracer is compatible.
Capacity:	This test method is not limited by tank capacity, however only portions of the tank system which within 10 feet of sample collection point are tested.
Waiting Time:	Waiting period after injection of the tracer into the tank is 7 to 30 days (generally two weeks).
Tracer Dosage:	Dosage of tracer is a factor of tank size and the frequency of tank refills according to manufacturer's recommendations.
Permeability:	Soil permeability must be greater than 1 Darcy. Soil permeability must be sufficient for transport of tracer through the backfill.
Probe:	Radius of influence of each probe is 10 feet; probes must be placed such that all possible locations and orientations are within the circle of influence.
Groundwater:	Depth to the water table present in the backfill must be determined.
Comments:	- Presence of frozen, saturated soil above the bottom of the tank may reduce the effectiveness of this test method. - Presence of groundwater above the bottom of the tank may also reduce the effectiveness of this test method (e.g. when applied to tanks containing water-miscible products or products whose specific gravity is greater than one).

Tracer Research Corporation
3855 N. Business Center Dr.
Tucson, AZ 85705
Tel: (800) 989-9929

Evaluators: Ken Wilcox Associates (1991)
Control Strategies Engineering (1992)

Dates of Evaluations: 10/04/91 & 5/92

Tracer Research Corporation

Tracer Tight Line Test

LINE TIGHTNESS TEST METHOD

Certification:	Leak rate of 0.1 gallon per hour with $P_D = 100\%$ & $P_{FA} = 0.0\%$.
Leak Threshold:	Detection of tracer chemical.
Applicability:	All fluid petroleum products and any other fluid with which the tracer is compatible.
Waiting Time:	Waiting period after injection of the tracer into the tank is on average 2 weeks, but must be no less than 1 week, and no more than 4 weeks. For very large systems, several days or weeks may be required to circulate tracer labeled fuel through all parts of the system. Under these circumstances the 1 week waiting period begins after the tracer reaches the pipeline being tested.
Tracer Dosage:	Dosage of tracer is a factor of tank size and the frequency of tank refills according to manufacturer's recommendations. Tracer labelled product should be circulated through the piping before the test period begins. Pressurized piping must be brought up to operating pressure or caused to operate on a daily basis.
Permeability:	Soil permeability must be greater than 1 Darcy. During probe sampling vacuum must not exceed 15 inches of mercury. Soil permeability must be sufficient for transport of tracer through the backfill.
Probe:	Radius of influence of each probe is 10 feet. Locating the pipelines should be done according to the manufacturer operating procedures for pipeline test results to be valid.
Comments:	Presence of frozen, saturated soil (frozen ground water) surrounding the piping may reduce the effectiveness of this test method. Presence of ground water surrounding the piping may also reduce the effectiveness of this test method when applied to piping containing water miscible products or products whose specific gravity is greater than one.

Tracer Research Corporation
3855 N. Business Center Dr.
Tucson, AZ 85705
Tel: (800) 989-9929

Evaluator: Control Strategies Engineering

Date of Evaluation: 05-77-92

Triangle Environmental

T.E.I. System 4000, Ver. 1.00 (Underfilled Test)

VOLUMETRIC TANK TIGHTNESS TEST METHOD

Certification:	Leak rate of 0.1 gallon per hour with $P_D = 99\%$ and $P_{FA} = 4.8\%$.
Leak Threshold:	0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
Applicability:	Gasoline, diesel, aviation fuel, fuel oil, waste oil and solvents.
Capacity:	The maximum tank capacity must be 15,000 gallons. The tank must be between 50 and 100% full.
Waiting Time:	Minimum waiting time between product delivery to the tank and test data collection must be 6 hours.
Test Period:	The minimum data collection time is determined by computer. The average data collection time during the evaluation was four hours. Leak rate is calculated from data of last 2 hours of test period.
Temperature:	A minimum of 3 thermistors must be used to determine the average temperature of the stored hazardous substance.
Ground Water:	Depth to the water table present in the backfill must be determined, and if it is above the bottom of the tank, product level is raised to provide minimum of 1 psi net pressure on the bottom of the tank.
Calibration:	Sensors must be calibrated before each test.
Comments:	<ol style="list-style-type: none"> 1. This equipment was not evaluated using manifolded tanks. 2. This equipment only tests the portion of the tank that contains product. 3. As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).

Triangle Environmental
172 West Verdugo Ave.
Burbank, CA 91502-2132
Tel: (818) 840-7020

Evaluator: United States Testing Co., Inc.

Evaluation Completed: 04-02-91

DRAFT

Triangle Environmental, Inc.

TEI System 5000, Ver. 1.0

NON-VOLUMETRIC TANK TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gallon per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.

Leak Threshold: A leak is declared if the acoustical noise level of the tank under vacuum is greater than the calibrated noise level (which is taken without vacuum).

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4, solvents and light liquids.

Capacity: The maximum tank capacity is 20,000 gallons. The tank must be at least 14% full. The microphone should be located within 24 feet of all points on the tank.

Waiting Time: There is no waiting time after product delivery to the tank.

Test Period: The data collection time is 1 minute.

Test Pressure: Vacuumed 1 psi is maintained at the bottom of the tank. If the vacuum cannot be maintained, see manufacturer's instructions.

Calibration: The sensor must be calibrated before each test.

Temperature: Acoustical signal is independent of product temperature.

Groundwater: Depth of the groundwater table in the backfill must be determined. This method cannot be used if the groundwater is above the bottom of the tank.

Comments:

- This test method was third-party certified using unleaded gasoline as the test product.
- During the third-party testing, the microphone was 24 feet away from the leak source.
- Headphones are used during the test to listen for the signal of air ingress.
- Noise signals are tape recorded (not digitally recorded).
- Manifolder tanks are identified and isolated prior to the test.
- This test method cannot be used if the backfill material is not porous.
- This test method may not be effective in some backfill, because some particles (such as clay) may plug a hole in the tank.
- If the soil is saturated with product, this test will not detect air or water ingress.

Triangle Environmental, Inc.
172 W. Verdugo Avenue
Burbank, CA 91502
Tel: (818) 840-7020

Evaluator: United States Testing Co. Inc.

Date of Evaluation: 02-04-93

DRAFT

Triangle Environmental, Inc.

TEI Ullage Test, Ver. 1.0

NON-VOLUMETRIC ULLAGE TANK TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gallon per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.

Leak Threshold: An increase in the acoustical noise level of the tank under vacuum due to air or water ingress indicates a leak.

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4, solvents and light liquids.

Capacity: The maximum ullage volume is 15,000 gallons. The microphone should be located within 24 feet of all points of the ullage portion of the tank.

Waiting Time: There is no waiting time if the test is conducted after the underfilled tank test.

Test Period: The data collection time is 1 minute.

Test Pressure: Vacuumed 1 psi is maintained in the ullage portion of the tank. If the vacuum cannot be maintained, see manufacturer's instructions.

Calibration: The sensor must be calibrated before each test.

Temperature: Acoustical signal is independent of product temperature.

Groundwater: Depth of the groundwater table in the backfill must be determined, and if it is above the product level, vacuum pressure must be adequate to detect an ingress of water.

Comments:

- This test method was third-party certified using unleaded gasoline as the test product.
- Manifolder tanks are identified and isolated prior to the test.
- During the third-party testing, the microphone was 24 feet away from the leak source.
- Headphones are used during the test to listen for the signal of air ingress.
- Noise signals are tape recorded.
- This test method may not be effective in some backfill, because some particles (such as clay) may plug a hole in the tank.
- If the soil is saturated with product, this test will not detect air or water ingress.

Triangle Environmental, Inc.
172 W. Verdugo Avenue
Burbank, CA 91502
Tel: (818) 840-7020

Evaluator: United States Testing Co. Inc.

Date of Evaluation: 05-05-93

LINE TIGHTNESS TEST METHOD

Certification: Leak rate of 0.1 gallon per hour with $P_D = 100.0\%$ and $P_{FA} = 0\%$.

Leak Threshold: 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, fuel oil #4 & #6, solvents and waste oil.

Specification: System tests fiberglass and/or steel piping.
The piping system volume must not exceed 80 gallons.
Tests are conducted at 150% of the line operating pressure.

Waiting Time: There is no minimum waiting time between delivery of product to the tank and the start of data collection.
Minimum waiting time between last dispensing of product through the pipeline system and the start of data collection is 15 minutes.

Temperature: Product temperature change per hour should be less than 4 °F.

Test Period: The minimum data collection time must be 15 minutes
Test data is acquired and recorded manually.
Manual calculations are performed by the operator on site.

Calibration: Sensors must be checked and calibrated semi-annually in accordance with manufacturer's instructions.

AUTOMATIC TANK GAUGING

Certification: Leak rate of 0.2 gallon per hour with $P_D = 96.6\%$ & $P_{FA} = 3.4\%$.

Leak Threshold: 0.1 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, and solvents.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be at least 90% full.

Waiting Time: Minimum waiting time between product delivery to the tank and test data collection must be 8 hours.

Test Period: The minimum data collection time must be 6 hours.
Test data must be acquired and recorded by a microprocessor.
Leak rate is calculated from average of subsets of all collected data.
There must be no dispensing or product delivery during the test.

Temperature: Minimum of 5 resistance temperature detectors must be used to determine the average temperature of the stored substance.

Water Sensor: A water sensor must be used to monitor changes in water level in the tank during the test.
Minimum water level detectable in the tank is 0.83 inches.
Minimum detectable water level change is 0.0116 inches.

Calibration: Temperature sensors and probes must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment only tests that portion of the tank which contains product.
As the product level is lowered, the leak rate in a leaking tank decreases (due to lower head pressure).
This system is identical to Engineered System's Image II ATGS.

DRAFT

Universal Sensors and Devices

Leak Alert System Models LAL-100, LA-01, LA-02, LA-04, LA-X4, LA-08, CATLAS
Liquid Sensor LALS-1

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: thermal conductivity

Test Results*:

	Commercial
	<u>Gasoline</u>
Accuracy (%)	100
Response time (min)	1.24
Recovery time (min)	<1
Product activation height (cm)	0.61
Lower Detection Limit (cm)	0.76

* at a flow rate of 0.04 gal/hr in a 2.6 cm diameter test chamber

Specificity Results:

Activated: diesel fuel, synthetic fuel, home heating oil #2, water

Manufacturer's Specifications:

Comments: EPA and many states require detection of 1/8 inch of product, which is 0.32 cm. The test procedures used were those in Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.

Universal Sensors and Devices, Inc.
9205 Alabama Ave., Unit C
Chatsworth, CA 91311
Tel: (818) 998-7121

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 06-01-94

DRAFT

Universal Sensors and Devices

Leak Alert System Models LAL-100, LA-01, LA-02, LA-04, LA-X4, LA-08, CATLAS
LAVS-1 MOS Vapor Sensor

VAPOR PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: metal oxide semiconductor

Test Results:

	Commercial	Synthetic	JP-4
	<u>Gasoline</u>	<u>Gasoline</u>	
Accuracy (%)	100	100	100
Detection Time (min:sec)	00:31	00:40	00:42
Fall Time (min:sec)	4:43	4:25	4:30
Lower Detection Limit (ppm)	100	Not det.	Not det.

Specificity Results (%):

Activated: Commercial gasoline, Synthetic gasoline, JP-4 jet fuel, n-Hexane, Toluene, Xylene(s)

Manufacturer's Specifications:

Comments: The test procedures used were those in Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods," June 29, 1990.

Universal Sensors and Devices, Inc.
9205 Alabama Ave., Unit C
Chatsworth, CA 91311
Tel: (818) 998-7121

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 06-01-94

USTest

UST 2000/LL (Underfilled Test)

VOLUMETRIC TANK TIGHTNESS TEST METHOD

Certification:	Leak rate of 0.1 gallon per hour with $P_D=98.12\%$ and $P_{FA}=1.88\%$.
Leak Threshold:	0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
Applicability:	Gasoline, diesel, and aviation fuel. Water, kerosene, and other liquids may be tested in consultation with manufacturer.
Capacity:	The maximum tank capacity is 15,000 gallons. The tank must be at least 15% full. There must be at least 20 inches and not more than 60 inches of product in the tank.
Waiting Time:	Minimum waiting period between product delivery and test data collection is usually between 3 to 12 hours. Testing may begin when the rate of product temperature change does not exceed 0.1 degrees F per hour.
Test Period:	The minimum data collection time must be 2 hours. Test data is acquired and recorded by a computer, which does a regression analysis to determine the leak rate. An ultrasonic device is used to measure changes in product level.
Temperature:	Change in temperature is determined via a measurement of the change in the speed of sound.
Ground Water:	Depth to the water table present in the backfill must be determined, and if it is above the bottom of the tank, product level must be adjusted to provide a net pressure of at least +/- 1.0 psi on the bottom of the tank.
Comments:	This equipment was not evaluated using manifolded tanks. This system tests only the portion of the tank containing product. As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).

USTest
P.O. Box 53835
Lafayette, LA 70505
Tel: (318) 981-9421

Evaluator: Ken Wilcox Associates

Date of evaluation: 05-09-94

USTest

UST 2000/P (Underfilled Test)

VOLUMETRIC TANK TIGHTNESS TEST METHOD

Certification:	Leak rate of 0.1 gallon per hour with $P_D=99.9\%$ and $P_{FA}=0.1\%$ for tanks up to 15,000 gallons. Leak rate of 0.1 gph with $P_D=99.7\%$ and $P_{FA}=0.3\%$ for tanks up to 45,000 gallons.
Leak Threshold:	0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
Applicability:	Gasoline, diesel, and aviation fuel. Water and kerosene and other liquids may be tested in consultation with manufacturer.
Capacity:	The maximum tank capacity is 45,000 gallons. The tank must be at least 78.6% full.
Waiting Time:	Minimum waiting period for tanks up to 45,000 gallons must be determined from the manufacturer's chart of Wait Time versus Tank Volume, and this chart must be included in the tank test report.
Test Period:	The minimum data collection time for tanks between 10,000 and 45,000 gallons is determined from the manufacturer's chart of Differential Volume versus Test Duration. The line labelled $P_D = 99.9\%$ must be used. This chart must be included in the tank test report. Test data is acquired and recorded by a computer, which does a regression analysis to determine the leak rate.
Temperature:	Change in temperature is determined via a measurement of the change in the speed of sound.
Ground Water:	Depth to the water table present in the backfill must be determined, and if it is above the bottom of the tank, product level must be adjusted to provide a net pressure of at least 0.5 psi on the bottom of the tank.
Comments:	This equipment was not evaluated using manifolded tanks. This system tests only the portion of the tank containing product. As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).

USTest
P.O. Box 53835
Lafayette, LA 70505
Tel: (318) 981-9421

Evaluator: Midwest Research Institute, 1000 - 10,000 gal, 12-05-90
Ken Wilcox Associates, 10,000 - 45,000 gal, 08-04-92

UST 2000/U (2.0 psi and -1.0 psi)

NON-VOLUMETRIC ULLAGE TANK TIGHTNESS TEST METHOD

- Certification:** Leak rate of 0.1 gallon per hour with $P_D = 100\%$ and $P_{FA} = 0\%$.
- Leak Threshold:** A substantial increase in the noise signal (under vacuum or pressure) over the background signal (no pressure or vacuum applied) in the frequency interval of 10 kHz to 20 kHz, is declared as a leak.
- Applicability:** Gasoline, diesel, aviation fuel, heavy fuel oils (#2 through #6), solvents, waste oil. Equipment is not in contact with the product.
- Capacity:** Ullage volume of 7,550 gallons or less for +2.0 psig and 5,250 gallons or less for -1.0 psig test.
- Waiting time:** There is no waiting time if the test is conducted after an underfilled tank tightness test.
- Test Period:** Minimum data collection time is 15 minutes.
- Test Pressure:** Tests are done at a net of +2.0 psi (pressure) or -1.0 psi (vacuum) in the ullage portion of the tank.
- Ground Water:** Depth to the water table present in the backfill must be determined. If it is above the product level, the test under vacuum must not be conducted. Net outward pressure throughout the ullage must exceed 2.0 psi.
- Calibration:** Test equipment is checked by the tester before each test.
- Comments:** This is an ullage test only, the portion of the tank that contains product must be tested with an underfilled test method.
During the third-party certification unleaded gasoline was the test product.
During the third-party certification microphone was less than 8.5 feet from the leak source.
Surrounding acoustical noise can interfere with the test result. If the background noise is above a certain threshold, test is inconclusive.
Vibration due to nearby equipment or dripping condensation can interfere with this test.
This equipment is not third-party certified using manifolded tanks.

USTest
P.O. Box 53835
Lafayette, LA 70505
Tel: (318) 981-9421

Evaluator: Ken Wilcox Associates

Date of Evaluation: 03-24-92

USTMAN SIR 1.91 (quantitative)

STATISTICAL INVENTORY RECONCILIATION TEST METHOD

- Certification:** Method is certified to detect a 0.1 gph leak rate with $P_D = 98.4\%$ & $P_{FA} = 1.6\%$.
- Leak Threshold:** A leak is declared when a continuous loss exceeding 0.1 gallon per hour at the 5% level of significance is detected.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Tank Capacity:** Maximum tank capacity may not exceed 18,000 gallons.
- Data Requirement:** Minimum of 42 days of product level and flow through data is required.
- Comments:** Of the 41 data sets submitted for analysis, four data sets were not analyzed, 7 were inconclusive.
- This evaluation did not include data sets from manifolded tanks.
- The median monthly throughput for tanks used in this evaluation was 10,978 gallons.
- Leak rates ranging from 0.048 to 0.201 gph were used in the evaluation.
- Data sets used in this evaluation were supplied by the evaluator.

USTMAN Industries Inc.
12285 West Bayaud Avenue, Suite 110
Lakewood, CO 80228
Tel: (303) 986-8011

Evaluator: Ken Wilcox Associates

Date of Evaluation: 10-31-91

USTMAN Industries, Inc.

USTMAN SIR Version 94.1 (quantitative)

STATISTICAL INVENTORY RECONCILIATION TEST METHOD

Certification: Method is certified to detect a 0.10 gph leak rate with $P_D = >99\%$ and $P_{FA} = <1.6\%$.

Leak Threshold: A leak is declared when leak rate exceeds 0.05 gallons per hour.

Applicability: Gasoline, diesel, aviation fuel, and fuel oil #4.

Tank Capacity: Maximum tank capacity shall not exceed 30,000 gallons.

Data Requirement: Minimum of 30 days of product level and flow through data.

Comments: All 53 data sets presented for evaluation were evaluated with conclusive results.

The median monthly throughput of tanks used in this evaluation was 25,408 gallons.

Leak rates of 0.05, 0.1, and 0.2 gph were used in the evaluation.

Data sets used in this evaluation were supplied by the evaluator and some data sets used an USTMAN SIR 1.91 (0.1 gph) analysis as documentation that tanks in this evaluation were tight.

This evaluation included some data from manifolded tanks.

USTMAN Industries Inc.
12265 West Bayaud Avenue, Suite 110
Lakewood, CO 80228
Tel: (303) 986-8011

Evaluator: Ken Wilcox Associates

Date of Evaluation: 03-31-94

USTMAN Industries, Inc.

YES SIR 90 (qualitative)

STATISTICAL INVENTORY RECONCILIATION TEST METHOD

Certification: Method is certified to detect a 0.2 gph leak rate with $P_D = 96.3\%$ & $P_{FA} = 3.9\%$.

Leak Threshold: A leak is declared when a consistent loss exceeding 0.1 gallon per hour that is statistically significant from zero at the 5% confidence level.

Product Applicability: Gasoline, diesel, aviation fuel, and fuel oil #4.

Tank Capacity: Maximum tank capacity may not exceed 15,000 gallons.

Data Requirement: Minimum of 35 days of product level and flow through data.

Comments: Of the 120 data sets evaluated by the method, 15 were inconclusive.

This evaluation did not include data from manifolded tanks.

The median monthly throughput for tanks used in this evaluation was 15,867 gallons.

Data set used in this evaluation were supplied by the evaluator.

USTMAN Industries Inc.
12265 West Bayaud Avenue, Suite 110
Lakewood, CO 80228
Tel: (303) 986-8011

Evaluator: Midwest Research Institute

Date of Evaluation: 12-17-80

Vaporless Manufacturing

Vaporless LD 2000

AUTOMATIC MECHANICAL LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gallon per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.

Leak Threshold: 1.7 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel and solvent.

Specification: System is installed on pressurized flexible piping.
The piping system volume must not exceed 129 gallons.
Tests are conducted at the line operating pressure.

Waiting Time: There is no waiting period between last dispensing and testing.
There is no waiting period between product delivery and testing.

Test Period: The minimum test time (response time) is 5 seconds.

System Features: This system is permanently installed on the piping and automatically tests the line.
It uses a preset threshold and a single test to determine whether the piping is leaking.
If a leak is detected, this system restricts fuel flow to dispenser.

Calibration: Equipment must be checked annually in accordance with manufacturer's instructions.

Vaporless Manufacturing
9234 East Valley Rd., Suite C
Prescott Valley, AZ 86314
Tel: (602) 775-5191

Evaluator: Ken Wilcox Associates

Date of Evaluation: 11-19-90

Vaporless Manufacturing

Vaporless LD 2000E

AUTOMATIC MECHANICAL LINE LEAK DETECTOR (Hourly Test)

Certification: Leak rate of 3.0 gallon per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.

Leak Threshold: 2.0 gallons per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel and solvent.

Specification: System is installed on flexible piping.
The piping system volume must not exceed 59.6 gallons.
Tests are conducted at the line operating pressure.

Waiting Time: There is no waiting period between last dispensing and testing.
There is no waiting period between product delivery and testing.

Test Period: The minimum test time (response time) is 30 seconds.

System Features: This system is permanently installed on the piping and automatically tests the line.
It uses a preset threshold and a single test to determine whether the piping is leaking.
If a leak is detected, this system restricts fuel flow to dispenser.

Calibration: Equipment must be checked annually for capability of detecting a leak of 3.0 gallons per hour.

Comments: Enviroflex piping with a bulk modulus of 1,352 was used during the third-party evaluation.

Vaporless Manufacturing
9234 East Valley Rd., Suite C
Prescott Valley, AZ 86314
Tel: (602) 775-5191

Evaluator: Ken Wilcox Associates

Date of Evaluation: 12-11-92

AUTOMATIC MECHANICAL LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gallon per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.

Leak Threshold: 2.5 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel and solvent.

Specification: System is installed on pressurized fiberglass and steel piping. The piping system volume must not exceed 129 gallons. Tests are conducted at the line operating pressure.

Waiting Time: There is no waiting period between last dispensing and testing. There is no waiting period between product delivery and testing.

Test Period: The minimum test time (response time) is 1 minute.

System Features: This system is permanently installed on the piping and automatically tests the line. It uses a preset threshold and a single test to determine whether the piping is leaking. If a leak is detected, this system restricts fuel flow to dispenser.

Calibration: Equipment must be checked annually in accordance with manufacturer's instructions.

Vaporless Manufacturing
9234 East Valley Rd., Suite C
Prescott Valley, AZ 86314
Tel: (602) 775-5191

Evaluator: Ken Wilcox Associates

Date of Evaluation: July 13, 1993

AUTOMATIC MECHANICAL LINE LEAK DETECTOR

Certification: Leak rate of 3.0 gallon per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.

Leak Threshold: 2.0 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel.

Specification: System is installed on pressurized steel and fiberglass piping. Piping system volume must not exceed 320 gallons. Tests are conducted at the line operating pressure.

Waiting Time: There is no waiting times between last dispensing and testing.

Test Period: The minimum test time (response time) is 9 seconds.

Calibration: Equipment must be checked annually in accordance with manufacturer's instructions.

Vaporless Manufacturing
9234 East Valley Rd., Suite C
Prescott Valley, AZ 86314
Tel: (602) 775-5191

Evaluator: Ken Wilcox Associates

Date of Evaluation: 08-20-93

DRAFT

Veeder-Root

TLS-250/300/350 UST ATGS
with 7842 Digital Sensing Capacitance Probe

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.2 gallon per hour with $P_D = 99\%$ & $P_{FA} = 1\%$.

Leak Threshold: 0.10 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, and solvents.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be between 50 and 95% full.

Waiting Time: Minimum waiting time between product delivery to the tank and test data collection must be 8.3 hours.

Test Period: The minimum data collection time must be 5 hours.
Test data must be acquired and recorded by a computer.
There must be no dispensing or product delivery during the test.

Temperature: A temperature-average probe must be used to determine the average temperature of the stored hazardous substance.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 1.40 inches.
Minimum change in water level that can be detected is 0.040 inches.

Calibration: Temperature sensors and probe must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment only tests the portion of the tank that contains product.
As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).

Veeder-Root
125 Powder Forest Drive
Simsbury, CT 06070-2003
Tel: (203) 651-2700

Evaluator: Midwest Research Institute

Date of Evaluation: 01/18/91

DRAFT

Veeder-Root

TLS-250/250i/350 UST ATGS
with 8472 Digital Sensing Capacitance Probe

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.2 gallon per hour with $P_D = 99\%$ & $P_{FA} = 0.2\%$.

Leak Threshold: 0.126 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, and solvents.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be between 50 and 95% full.

Waiting Time: Minimum waiting time between product delivery to the tank and test data collection must be 8.3 hours.

Test Period: The minimum data collection time must be 2 hours.
Test data must be acquired and recorded by a computer.
Leak rate is calculated from converting the level signals from the probe during the test period to change in temperature-compensated volume.
There must be no dispensing or product delivery during the test.

Temperature: A minimum of 5 thermistors must be used to determine the average temperature of the stored hazardous substance.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 1.52 inches.
Minimum change in water level that can be detected is 0.027 inches.

Calibration: Temperature sensors and probe must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment only tests the portion of the tank that contains product.
As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).

Veeder-Root
125 Powder Forest Drive
Simsbury, CT 06070-2003
Tel: (203) 651-2700

Evaluator: Midwest Research Institute

Date of Evaluation: 4/25/91

DRAFT

Veeder-Root

TLS-250/300/350 UST ATGS
with 8472 Digital Sensing Capacitance Probe

AUTOMATIC TANK GAUGING SYSTEM (0.1 gph test mode)

Certification: Leak rate of 0.1 gallon per hour with $P_D = 99\%$ & $P_{FA} = 0.1\%$.

Leak Threshold: 0.071 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, and solvents.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be between 50% and 95% full.

Waiting Time: Minimum waiting time between product delivery to the tank and test data collection must be 8.25 hours.

Test Period: The minimum data collection time must be 2 hours.
Test data must be acquired and recorded by a computer.
Leak rate is calculated from the difference between first and last data collected.
There must be no dispensing or product delivery during the test.

Temperature: A minimum of 5 thermistors must be used to determine the average temperature of the stored product.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 1.52 inches.
Minimum change in water level that can be detected is 0.027 inches.

Calibration: Temperature sensors and probe must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment only tests the portion of the tank that contains product.
As the product level is lowered, the leak rate in a leaking tank decreases (due to lower head pressure).

Veeder-Root
125 Powder Forest Drive
Simsbury, CT 06070-2003
Tel: (203) 651-2700

Evaluator: Midwest Research Institute

Date of Evaluation: 04-25-91

DRAFT

Veeder-Root

TLS-200/200i/250/250i/300/350/400 UST ATGS
with 8473 Digital Sensing Magnetostrictive Probe

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.2 gallon per hour with $P_D = 99\%$ & $P_{FA} = 0.1\%$.

Leak Threshold: 0.093 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, and solvents.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be between 50 and 95% full.

Waiting Time: Minimum waiting time between product delivery to the tank and test data collection must be 8.3 hours.

Test Period: The minimum data collection time must be 2 hours.
Test data must be acquired and recorded by a computer.
Leak rate is calculated from converting the level signals from the probe during the test period to change in temperature-compensated volume.
There must be no dispensing or product delivery during the test.

Temperature: A minimum of 5 thermistors must be used to determine the average temperature of the stored hazardous substance.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 1.32 inches.
Minimum change in water level that can be detected is 0.024 inches.

Calibration: Temperature sensors and probe must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment only tests the portion of the tank that contains product.
As the product level is lowered the leak rate in a leaking tank decreases (due to lower head pressure).

Veeder-Root
125 Powder Forest Drive
Simsbury, CT 06070-2003
Tel: (203) 651-2700

Evaluator: Midwest Research Institute

Date of Evaluation: 4/26/91

DRAFT

Veeder-Root

TLS-200/200i/250/250i/300/350/400 UST ATGS
with 8473 Digital Sensing Magnetostrictive Probe

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.1 gallon per hour with $P_D = 99\%$ & $P_{FA} = 1\%$.

Leak Threshold: 0.069 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, aviation fuel, and solvents.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be at least 95% full.

Waiting Time: Minimum waiting time between product delivery to the tank and test data collection must be 8.25 hours.

Test Period: The minimum data collection time must be 3 hours.
Test data must be acquired and recorded by computer.
Leak rate is calculated from the difference between first and last data collected.
There must be no dispensing or product deliver during the test.

Temperature: A minimum of 5 thermistors must be used to determine the average temperature of the stored product.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 1.32 inches.
Minimum change in water level that can be detected is 0.024 inches.

Calibration: Temperature sensors and probe must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment only tests the portion of the tank that contains product.
As the product level is lowered, the leak rate in a leaking tank decreases (due to lower head pressure).

Veeder-Root
125 Powder Forest Drive
Simsbury, CT 06070-2003
Tel: (203) 651-2700

Evaluator: Midwest Research Institute

Date of Evaluation: 04-26-91

DRAFT

Veeder-Root

Veeder-Root 3000 Tank Level Module - version TLP2
Normal/Rapid Test Mode - Magnetostrictive Probe

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.2 gallon per hour with $P_D = 95.0\%$ & $P_{FA} = 0.1\%$ in normal test mode and $P_D = 95.0\%$ & $P_{FA} = 5.0\%$ in rapid test mode.

Leak Threshold: 0.10 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, and aviation fuel.

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be between 50% and 95% full.

Waiting Time: Minimum waiting time between product delivery to the tank and test data collection must be 6 hours and 40 minutes.

Test Period: The minimum data collection time must be 4 hours for normal test mode and 1.2 hours for rapid test mode.
Test data must be acquired and recorded by a microprocessor.
Leak rate is calculated from data determined to be valid by statistical analysis.
There must be no dispensing or product delivery during the test.

Temperature: A minimum of 5 resistance temperature detectors must be used to determine the average temperature of the stored substance.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 0.49 inches.
Minimum detectable change in water level is 0.05 inches.

Calibration: Temperature sensors and probes must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated using manifolded tanks.
This equipment only tests that portion of the tank which contains product.
As the product level is lowered, the leak rate in a leaking tank decreases (due to lower head pressure).
This system was formerly called CEI 3000 and was manufactured by Control Engineers.

Veeder-Root
114 Menard Road
Houma, LA 70363
Tel: (504) 872-4541

Evaluator: Midwest Research Institute

Date of Evaluation: 05-27-92

Veeder-Root 3000 Tank Level Module - version TLP2
Normal/Rapid Test Mode - Magnetostrictive Probe

AUTOMATIC TANK GAUGING SYSTEM

Certification: Leak rate of 0.1 gallon per hour with $P_D = 99.2\%$ & $P_{FA} = 0.08\%$ in normal test mode and $P_D = 95.0\%$ & $P_{FA} = 5.0\%$ in rapid test mode.

Leak Threshold: 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability: Gasoline, diesel, and aviation fuel

Capacity: The maximum tank capacity is 15,000 gallons.
The tank must be at least 95% full.

Waiting Time: Minimum waiting time between product delivery to the tank and test data collection must be 6 hours and 40 minutes.

Test Period: The minimum data collection time must be 6.38 hours for normal test mode and 2.67 hours for rapid test mode.
Test data must be acquired and recorded by a microprocessor.
Leak rate is calculated from data determined to be valid by statistical analysis.

Temperature: A minimum of 5 resistance temperature detectors must be used to determine the average temperature of the stored substance.

Water Sensor: A water sensor must be used to detect water incursion.
Minimum water level detectable in the tank is 0.49 inches.
Minimum detectable change in water level is 0.05 inches.

Calibration: Temperature sensors and probes must be checked and calibrated annually in accordance with manufacturer's instructions.

Comments: This equipment was not evaluated on manifolded tanks.
This equipment only tests that portion of the tank which contains product.
As the product level is lowered, the leak rate in a leaking tank decreases (due to lower head pressure).
This system was formerly called CEI 3000 and was manufactured by Control Engineers.

Veeder-Root
 114 Menard Road
 Houma, LA 70363
 Tel: (504) 872-4589

Evaluator: Midwest Research Institute

Date of Evaluation: 05/21/92

350 Series UST Monitoring Systems: Models ILS-350, TLS-350, TLS-350R
Groundwater Sensor (794380-621, -622, -624)

LIQUID-PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
 Sampling frequency: continuous
 Operating principle: electrical conductivity

Test Results:

	Commercial Gasoline	Synthetic Gasoline
Accuracy(%)	100	100
Detection time(min:sec)	08:55	06:18
Fall Time (min:sec)	54:50	26:02
Lower detection limit(cm)	0.02	0.02

Specificity Results:

Activated: commercial gasoline, n-Hexane, diesel fuel, Jet-A fuel, toluene, synthetic gasoline, xylene(s).

Manufacturer's Specifications:

Comments:

EPA and many states require detection of 1/8 inch of product, which is 0.32 cm. This detector is reusable.

Veeder-Root
 125 Powder Forest Drive
 Simsbury, CT 06070-2003
 Tel: (203) 651-2700

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 11-20-91 (TLS-350) and 07-28-92

Veeder-Root

TLS-350

Discriminating Interstitial Liquid Sensor

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
 Sampling frequency: continuous
 Operating principle: capacitance change / ultrasonic

Test Results*:

	Commercial Gasoline	Water
Accuracy (%)	100	100
Response time (min)	0.46	1.36
Recovery time (min)	<1	<1
Product activation height (cm)	0.23	0.69

* at a flow rate of 0.94 gal/hr in 14.4 cm diameter test chamber

Specificity Results:

Activated: diesel fuel (at liquid height of 0.37 cm), synthetic fuel (at 0.35 cm), home heating oil #2 (at 0.43 cm).

Manufacturer's Specifications:

Comments: EPA and many states require detection of 1/8 inch of product, which is 0.32 cm, for ground water monitoring. The detectors are listed as interstitial due to intended use. The test procedures used were those in Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.

Veeder-Root
 125 Powder Forest Dr.
 Simsbury, CT 06070-2003
 Tel: (203) 651-2700

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 06-30-93

Veeder-Root

TLS-350

Dispenser Pan Sensors and Containment Sump Sensors

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
 Sampling frequency: continuous
 Operating principle: electrical conductivity / ultrasonic

Test Results*:

	Commercial Gasoline	Water	
		Low	High
Accuracy (%)	100	100	100
Response time (min)	6.59	4.60	5.00
Recovery time (min)	17.17	<1	<1
Product activation height (cm)	3.40	2.45	20.3

* at a flow rate of 0.17 gal/hr in a 6.0 cm diameter test chamber.

Specificity Results:

Activated: diesel fuel (at liquid height of 4.75 cm), synthetic fuel (at 2.58 cm), home heating oil #2 (at 4.67 cm).

Manufacturer's Specifications:

Comments: EPA and many states require detection of 1/8 inch of product, which is 0.32 cm, for ground water monitoring. The test procedures used were those in Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.

Veeder-Root
 125 Powder Forest Dr.
 Simsbury, CT 06070-2003
 Tel: (203) 651-2700

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 05-26-93

Veeder-Root

TLS-350
Dual and Single Stage Hydrostatic Sensors

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: float switch

Test Results*:

	50 wt% Ethylene glycol in water		30 wt% Calcium chloride in water	
	Up	Down	Up	Down
Accuracy (%)	100	100	100	100
Response time (min)	22.52	35.75	20.46	37.07
Recovery time (min)	<1	<1	<1	<1
Product activation height (cm)	33.1	3.9	32.2	4.0

* at a flow rate of 0.33 gal/hr in a test chamber of 7.8 cm diameter.

Specificity Results:

Not applicable

Manufacturer's Specifications:**Comments:**

This point sensor is intended to monitor the level of either ethylene glycol or calcium chloride solutions in the interstitial or annular space of a double-walled tank, by triggering an alarm if any significant gain or loss of solution occurs. Evaluation was performed using procedures from Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991, modified to accommodate the intended purpose.

Veeder-Root
125 Powder Forest Dr.
Simsbury, CT 06070-2003
Tel: (203) 651-2700

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 12-07-92

Veeder-Root

TLS-250i, TLS 250i Plus, ILS 250, ILS 350, TLS-350
Interstitial Liquid Sensor for Fiberglass Tanks (0794390-401)

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: float switch

Test Results*:

	Commercial Gasoline**	Commercial Gasoline***
	100	100
Accuracy (%)	100	100
Response time (min)	3.66	3.45
Recovery time (min)	<1	<1
Product activation height (cm)	1.28	1.27
Lower Detection Limit (cm)	1.84	1.65

* at a flow rate of 0.19 gal/hr in 7.6 cm diameter test chamber

Specificity Results:

Activated: diesel fuel, synthetic fuel, home heating oil #2, water

Manufacturer's Specifications:

Comments: EPA and many states require detection of 1/8 inch of product, which is 0.32 cm, for ground water monitoring. The test procedures used were those in Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.

** TLS-250, TLS 250i Plus, ILS 250

*** ILS 350, TLS-350

Veeder-Root
125 Powder Forest Dr.
Simsbury, CT 06070-2003
Tel: (203) 651-2700

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 07-17-92

Veeder-Root

TLS-250, TLS 250i Plus, ILS 250, ILS 350, TLS-350
Interstitial Liquid Sensor for Steel Tanks (0794390-420)

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: float switch

Test Results:

	Commercial Gasoline*	Commercial Gasoline**
Accuracy (%)	100	100
Response time (min)	6.00	6.51
Recovery time (min)	<1	<1
Product activation height (cm)	3.67	3.62
Lower Detection Limit (cm)	4.05	4.17

Specificity Results:

Activated: diesel fuel, synthetic fuel, home heating oil #2, water

Manufacturer's Specifications:

Comments: EPA and many states require detection of 1/8 inch of product, which is 0.32 cm, for ground water monitoring. The test procedures used were those in Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.

* TLS-250, TLS 250i Plus, ILS 250, at a flow rate of 0.13 gal/hr in 4.8 cm diameter test chamber
** ILS 350, TLS-350, at a flow rate of 0.12 gal/hr in 4.8 cm diameter test chamber

Veeder-Root
125 Powder Forest Dr.
Simsbury, CT 06070-2003
Tel: (203) 651-2700

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 07-17-92

Veeder-Root

TLS-250i, TLS 250i Plus, ILS 250, ILS 350, TLS-350
Liquid Sensor for Sumps (0794390-208)

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: float switch

Test Results:

	Commercial Gasoline*	Commercial Gasoline**
Accuracy (%)	100	100
Response time (min)	8.19	8.49
Recovery time (min)	<1	<1
Product activation height (cm)	4.12	3.95
Lower Detection Limit (cm)	4.67	4.36

Specificity Results:

Activated: diesel fuel, synthetic fuel, home heating oil #2, water

Manufacturer's Specifications:

Comments: EPA and many states require detection of 1/8 inch of product, which is 0.32 cm, for ground water monitoring. The test procedures used were those in Carnegie Mellon Research Institute's "Test Procedures for Third Party Evaluation of Leak Detection Methods: Point Sensor Liquid Contact Leak Detection Systems": Final Report - November 11, 1991.

* TLS-250, TLS 250i Plus, ILS 250, at a flow rate of 0.15 gal/hr in 5.8 cm diameter test chamber
** ILS 350, TLS-350, at a flow rate of 0.14 gal/hr in 5.8 cm diameter test chamber

Veeder-Root
125 Powder Forest Dr.
Simsbury, CT 06070-2003
Tel: (203) 651-2700

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 07-17-92

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Veeder-Root

TLS-350

Solid-State Pan/Sump Sensor (794380-321, -351), Piping Sump Sensor (794380-208), Micro Sensor (794380-340)

LIQUID-PHASE INTERSTITIAL DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: product permeable / ultrasonic / float switch

Test Results:

	<u>Gasoline</u>	<u>Diesel</u>	<u>Water</u>
<u>Piping Sump Sensor (794380-208)</u>			
Min. Product Level (cm)	3.51	3.40	3.03
Precision	0.011	0.011	0.011
Detection Time (sec)	<1	<1	<1
<u>Solid-State Pan/Sump Sensor (794380-321, -351)</u>			
Min. Product Thickness (cm)	2.60	2.50	2.60
Precision	0.010	0.010	0.010
Detection Time (sec)	<1	<1	<1
<u>Micro Sensor (794380-340)</u>			
Min. Product Thickness (cm)	0.51	0.46	0.48
Precision	0.011	0.007	0.007
Detection Time (sec)	<1	<1	<1

Specificity Results (%):

Commercial gasoline 100
Diesel Fuel 100
Water 100

Manufacturer's Specifications:

Comments: EPA and many states require detection of 1/8 inch of product, which is 0.32 cm, for ground water monitoring. The test procedures used were modified by the evaluator from those in EPA's "Standard Test Procedures for Evaluation Leak Detection Methods: Liquid-Phase Out-of-Tank Product Detectors," March 1990.

Veeder-Root
125 Powder Forest Dr.
Simsbury, CT 06070-2003
Tel: (203) 651-2700

Evaluator: Ken Wilcox Associates

Date of Evaluation: 10-20-94

Veeder-Root

ILS 350, TLS-350

Adsistor Vapor Probes

VAPOR PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: qualitative
Sampling frequency: continuous
Operating principle: adsistor

Test Results:

	<u>Commercial Gasoline</u>	<u>Synthetic Gasoline</u>	<u>JP-4</u>
Accuracy (%):	100	0	100
Detection Time (min:sec):	7:46	Not App.	17:01
Fall Time (min:sec):	2:38	Not App.	3:05
Lower Detection Limit (ppm):	500	> 1000	500

Specificity Results (%):

Activated: Commercial gasoline, JP-4 jet fuel
No response: n-Hexane, Synthetic gasoline, Toluene, Xylene(s)

Manufacturer's Specifications:

Comments: The test procedures used were those in Radian Corporation's draft report "Development of Procedures to Assess the Performance of External Leak Detection Devices: Vapor-Phase ASTM-Formatted Methods," June 29, 1990.

Veeder-Root
125 Powder Forest Dr.
Simsbury, CT 06070-2003
Tel: (203) 651-2700

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 07-24-92

TLS-350 Line Leak Detector, Series 8475

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

- Certification:** Leak rate of 3.0 gallons per hour with $P_D = 100\%$ & $P_{FA} = 0\%$.
- Leak Threshold:** 1.5 gallons per hour (a leak is declared if the output of the measurement system exceeds this threshold).
- Applicability:** Gasoline, diesel, aviation fuel, and solvent.
- Specification:** System is installed on pressurized fiberglass and steel piping. The piping system volume must not exceed 41 gallons. Tests are conducted at the line operating pressure. The mechanical line leak detector must be removed from the pipeline system.
- System is installed on pressurized flexible piping. The piping volume must not exceed 158.4 gallons. Tests are conducted at the line operating pressure. The mechanical line leak detector must be removed from the pipeline.
- Waiting Time:** There is no waiting period between product delivery and testing. Minimum waiting period between last dispensing and testing depends on volume of product and temperature gradient which is determined by the system's computer.
- Test Period:** The minimum data collection time (response time) is 12 minutes. Test data must be acquired and recorded by a microprocessor. Calculations are automatically done by the microprocessor.
- System Features:** This system is permanently installed on the pipeline and automatically tests the line. Uses a preset threshold and a single test to determine whether the pipeline is leaking. If a leak is declared, this system displays a message and triggers an alarm.
- Calibration:** Equipment must be checked and calibrated annually in accordance with manufacturer's instructions.

Evaluator: Ken Wilcox Associates, Inc.

Date of Evaluation: 08/04/93

Veeder-Root
125 Powder Forest Drive
Simsbury, CT 06070-2003
Tel: (203) 651-2700

TLS-350 Line Leak Detector, Series 8475

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

- Certification:** Leak rate of 0.20 gallon per hour with $P_D = 100.0\%$ & $P_{FA} = 0\%$.
- Leak Threshold:** 0.10 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
- Applicability:** Gasoline, diesel, aviation fuel, and solvent.
- Specification:** System is installed on pressurized fiberglass and steel piping. The piping system volume must not exceed 41 gallons. Tests are conducted at the line operating pressure. The mechanical line leak detector must be removed from the pipeline system.
- System is installed on pressurized flexible piping. The piping volume must not exceed 158.4 gallons. Tests are conducted at the line operating pressure. The mechanical line leak detector must be removed from the pipeline.
- Waiting Time:** There is no waiting period between product delivery and testing. Minimum waiting period between last dispensing and testing depends on volume of product and temperature gradient which is determined by the system's computer.
- Test Period:** Minimum data collection time must be 0.75 to 8.85 hours. Test data must be acquired and recorded by a microprocessor. Calculations are automatically done by the microprocessor.
- System Features:** This system is permanently installed on the pipeline and automatically tests the line. Uses a preset threshold and a single test to determine whether the pipeline is leaking. If a leak is declared, this system displays a message, triggers an alarm, and shuts down the dispensing system.
- Calibration:** Equipment must be checked annually and calibrated in accordance with manufacturer's instructions.

Evaluator: Ken Wilcox Associates

Date of Evaluation: 08/04/93

Veeder-Root
125 Powder Forest Drive
Simsbury, CT 06070-2003
Tel: (203) 651-2700

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Veeder-Root

TLS-350 Line Leak Detector, Series 8475

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

- Certification:** Leak rate of 0.1 gallon per hour with $P_D=100.0\%$ & $P_{FA}=0\%$.
- Leak Threshold:** 0.079 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
- Applicability:** Gasoline, diesel, aviation fuel, and solvent.
- Specification:** System is installed on pressurized fiberglass and steel piping. The piping system volume must not exceed 41 gallons. Tests are conducted at the line operating pressure. The mechanical line leak detector must be removed from the pipeline system.
- System is installed on pressurized flexible piping. The piping volume must not exceed 158.4 gallons. Tests are conducted at the line operating pressure. The mechanical line leak detector must be removed from the pipeline.
- Waiting Time:** There is no waiting period between product delivery and testing. Minimum waiting period between last dispensing and testing depends on volume of product and temperature gradient which is determined by the system's computer.
- Test Period:** Minimum data collection time must be 1.2 to 12.9 hours. Test data must be acquired and recorded by a microprocessor. Calculations are automatically done by the microprocessor.
- System Features:** This system is permanently installed on the pipeline and automatically tests the line. Uses a preset threshold and a single test to determine whether the pipeline is leaking. If a leak is declared, this system displays a message, triggers an alarm, and shuts down the dispensing system.
- Calibration:** Equipment must be checked annually and calibrated in accordance with manufacturer's instructions.

Veeder-Root
125 Powder Forest Drive
Simsbury, CT 06070-2003
Tel: (203) 651-2700

Evaluator: Ken Wilcox Associates

Date of Evaluation: 08/04/93

DRAFT

Veeder-Root

TLS Line Leak Detector, Series 8484

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

- Certification:** Leak rate of 3.0 gallon per hour with $P_D=100.0\%$ & $P_{FA}=0\%$.
- Leak Threshold:** 1.88 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
- Applicability:** Gasoline, diesel, aviation fuel, and solvent.
- Specification:** System is installed on pressurized fiberglass and steel piping. The piping system volume must not exceed 89 gallons. Tests are conducted at the line operating pressure. The mechanical line leak detector must be removed from the pipeline system.
- Waiting Time:** There is no waiting period between product delivery and testing. Minimum waiting period between last dispensing and testing is 0.27 hours.
- Test Period:** The minimum data collection time (response time) is 0.008 hours. Test data must be acquired and recorded by a microprocessor. Calculations are automatically done by the microprocessor.
- System Features:** This system is permanently installed on the pipeline and automatically tests the line. Uses a preset threshold and a single test to determine whether the pipeline is leaking. If a leak is declared, this system displays a message, triggers an alarm, and shuts down the dispensing system.
- Calibration:** Equipment must be checked annually and calibrated in accordance with manufacturer's instructions.

Veeder-Root
125 Powder Forest Drive
Simsbury, CT 06070-2003
Tel: (203) 651-2700

Evaluator: Midwest Research Institute

Date of Evaluation: 08/07/91

TLS Line Leak Detector, Series 8484

AUTOMATIC ELECTRONIC LINE LEAK DETECTOR

- Certification:** Leak rate of 0.10 gallon per hour with $P_D=100.0\%$ & $P_{FA}=0\%$.
- Leak Threshold:** 0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).
- Applicability:** Gasoline, diesel, aviation fuel, and solvent.
- Specification:** System is installed on pressurized fiberglass and steel piping.
The piping system volume must not exceed 89 gallons.
Tests are conducted at the line operating pressure.
The mechanical line leak detector must be removed from the pipeline system.
- Waiting Time:** There is no waiting period between product delivery and testing.
Minimum waiting period between last dispensing and testing is 2.5 hours.
- Test Period:** The minimum data collection (response time) is 0.3 hours
Test data must be acquired and recorded by a microprocessor.
Calculations are automatically done by the microprocessor.
- System Features:** This system is permanently installed on the pipeline and automatically tests the line.
Uses a preset threshold and a single test to determine whether the pipeline is leaking.
If a leak is declared, this system displays a message, triggers an alarm, and shuts down the dispensing system.
- Calibration:** Equipment must be checked annually and calibrated in accordance with manufacturer's instructions.

Veeder-Root
125 Powder Forest Drive
Simsbury, CT 06070-2003
Tel: (203) 651-2700

Evaluator: Midwest Research Institute

Date of Evaluation: 08/07/91

WRA Statistical Inventory Analysis, Version 5.1 (quantitative)

STATISTICAL INVENTORY RECONCILIATION TEST METHOD

- Certification:** Method is certified to detect a 0.1 gph leak rate with $P_D=99.98\%$ & $P_{FA}=0.02\%$.
- Leak Threshold:** A leak is declared when leak rate exceeds 0.05 gallons per hour.
- Applicability:** Gasoline, diesel, aviation fuel, and fuel oil #4.
- Tank Capacity:** Maximum tank capacity may not exceed 18,000 gallons.
- Data Requirement:** Minimum 30 days of product level and flow through data.
- Comments:** All 41 data sets were analyzed with conclusive results.
- The median monthly throughput for tanks used in the evaluation was 1000 gallons.
- Leak rates of 0.05, 0.10, and 0.20 gph were used in this evaluation.
- A portion of the data used in the evaluation was supplied by the vendor.
- This evaluation did not include data from manifolded tanks.

Warren Rogers Associates, Inc.
747 Aquidneck Avenue
Middletown, RI 02840
Tel: (401) 846-4747

Evaluator: Ken Wilcox Associates

Date of Evaluation: 12-18-90

DRAFT

Warrick Controls, Inc.

Model 5700 Meter
PVP-2 Sensor

VAPOR PHASE OUT-OF-TANK PRODUCT DETECTOR

Detector:

Output type: quantitative
Sampling frequency: continuous
Operating principle: adsistor

Test Results:

	Commercial Gasoline	Synthetic Gasoline	JP-4
Accuracy* (%):	25.4	-100.0	157.1
Bias* (%):	14.4	-100.0	108.3
Precision* (%):	7.6	Not det.	20.4
Detection Time* (min):	> 60	Not app.	> 60
Fall Time* (min):	38	Not app.	> 60
Lower Detection Limit (ppm):	1353.3	Not det.	Not det.

Specificity Results (%):

Not activated: Commercial gasoline, Synthetic gasoline, JP-4 jet fuel, n-Hexane, Toluene, Xylene(s)

Manufacturer's Specifications:

Comments: The test procedures used were those in Radian Corporation's draft report.
"Development of Procedures to Assess the Performance of External Leak Detection
Devices: Vapor-Phase ASTM-Formatted Methods," June 29, 1990.

Warrick Controls, Inc.
4237 Normandy Court
Royal Oak, MI 48073
Tel: (313) 545-2512

Evaluator: Carnegie Mellon Research Institute

Date of Evaluation: 09-10-91

DRAFT

Xerxes Corporation

Xerxes Trucheck Hydrostatic Monitoring System

DOUBLE WALLED TANK TIGHTNESS TEST

Certification:

Leak rate of 0.1 gallon per hour with $P_D = 99\%$ & $P_{FA} = 1\%$.

Leak Threshold:

0.05 gallon per hour (a leak is declared if the output of the measurement system exceeds this threshold).

Applicability:

Gasoline, diesel, aviation fuel, and fuel oil #4.

Capacity:

The maximum tank capacity must be 30,000 gallons.
The tank may be tested from 0 to 100% full.

Waiting Time:

There is no waiting time between product delivery and test data collection.

Test Period:

The minimum data collection time must be 10 hours.

Ground Water:

Ground water depth must be determined before and after the test. When ground water level is above the bottom of the tank but below the top, the test should be repeated if the ground water level increases by more than 7 inches during the test. When ground water is above the tank, the test should be repeated if the ground water level increases by more than 5 inches.

Xerxes Corporation
7901 Xerxes Ave.
Minneapolis, MN 55431
Tel: (612) 887-1890

Evaluator: Robert Plunkett, Ph.D.

Date of Evaluation: 01/07/93

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UNDER REVIEW SECTION

ALPHABETICAL BY COMPANY

January 17, 1995

UNDER REVIEW

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<u>Manufacturer</u>	<u>System; Test Type</u>	<u>Evaluator; Date of Evaluation</u>
Alert Technologies	2000-X & 2000-XB; Automatic Tank Gauging System (0.1 and 0.2 gph)	Ken Wilcox Associates; 02-28-94 & 06-22-94
Andover Controls	Andover Infinity CX9000, CX9200, and CMX240; Automatic Tank Gauging System (0.2 gph)	Ken Wilcox Associates; 05-24-93
Armstrong Monitoring	Alertmaster 5100: AMC-5007; Liquid-Phase Product Detector	Environment Canada; 12-03-92
Armstrong Monitoring	Alertmaster 5100: AMC F4000; Vapor-Phase Product Detector	Environment Canada; 12-03-92
Caldwell Systems	TM-700, ATG-100; Automatic Tank Gauging System (0.1 and 0.2 gph)	Wyle Labs; HWGA 01-20-89; 07-17-89
Campo/Miller	LS300-120 PLUS, LS300-120 PLUS A/S; Line Leak Detector (0.2 gph)	Jetronix Radio Engineering; 05-16-91
Campo/Miller	PL400; Line Tightness Test	Jetronix Radio Engineering; 05-16-91
Computerizing	Computank V. 3.0; Statistical Inventory Reconciliation	Ken Wilcox Associates; 09-17-92
Environment & Safety	EASI Level-Tru; Automatic Tank Gauging System (0.1 gph)	Midwest Research Institute
Gore & Associates	Leak Learn Model 1000; Liquid-Phase Product Detector	Carnegie Mellon Research Institute
Heath Consultants	Quick Check 2000; Volumetric Tank Tightness Test (Overfilled)	Midwest Research Institute; 03-12-90
HNU	DL-101, 10.2 eV Probe, HW-101, 11.7 eV Probe, ISPI-101, 10.2 eV Probe, PI-101, 11.7 eV Probe; Vapor-Phase Product Detector	Carnegie Mellon Research Institute

UNDER REVIEW

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<u>Manufacturer</u>	<u>System; Test Type</u>	<u>Evaluator; Date of Evaluation</u>
Incon Environmental	TS 1000; Automatic Tank Gauging System (0.1 gph)	Ken Wilcox Associates; 08-05-92
Incon Environmental	TS 2000; Automatic Tank Gauging System (0.1 gph)	Ken Wilcox Associates; 05-10-91
Keekor Environmental Products	TankTite Leak Detection Kernel Version 1.0; Automatic Tank Gauging System (0.2 gph)	Arizona State Univ.; 10-25-94
Mallory Controls	Pollulert Probes MD210, MD210RA, MD221TJ, MD221TJRA; Liquid-Phase Product Detector	Radian Corporation; 07-08-91
Marley Pump	ST 1400-1800, ATG, FMS, & LLM; Continuous Leak Detect. System (ATGS)	ADA Technologies; 10-12-92
Mine Safety Appliance	Tank-Check; Vapor-Phase Product Detector	Carnegie Mellon Research Institute; 05-31-91
NDE Environmental	Computerized VPLT; Volumetric Tank Tightness Test (overfilled)	Vista Research; 06-17-91
Petro Vend	Petrosonic III, Version 4.04C; Automatic Tank Gauging System	Underwriters Laboratories; 11-94
Petro Vend	SiteSentinel; Automatic Tank Gauging System	Underwriters Laboratories; 11-94
Practical Tank Management	Tank Management System 10; Statistical Inventory Reconciliation (Quantitative)	Ken Wilcox Associates; 12-02-91
Southeastern Liquid Analyzers	Tank Check 4.0; Statistical Inventory Reconciliation (Qualitative)	Petro Works; 06-03-93
Tanknology	VacuTest; Nonvolumetric Tank Tightness Test (Low Level Large Tank)	Ken Wilcox Associates;

UNDER REVIEW

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<u>Manufacturer</u>	<u>System; Test Type</u>	<u>Evaluator; Date of Evaluation</u>
Tidel Engineering	EMS 2000, 3000, 3500; Automatic Tank Gauging System (0.1 gph test)	Ken Wilcox Associates; 02-10-93
Tidel Engineering	EMS-3000: 301-0327-001, 301- 0329-001; Liquid-Phase Product Detector	Radian Corporation; 07-08-91
Tracer Research	Tracer Tight; Vapor-Phase Product Detector	Control Strategies Engineering; 05-77-92
USTest	UST 2000/P; Volumetric Tank Tightness Test (Large Tanks & Low Level Testing)	Ken Wilcox Associates; 08-04-92

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GLOSSARY

January 17, 1995

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GLOSSARY

Accuracy: The degree to which the measured leak rate agrees with the induced leak rate on the average. If a method is accurate, it has a very small or zero bias.

Leak threshold: This is the measured leak rate at which the test method declares the tank to be leaking. This leak rate will always be less than or equal to the leak rate requirement for the various release detection (RD) methods given in 40 CFR § 280 Subpart D-Release Detection. (Please note that some states and other regulatory authorities may have different requirements). The minimum threshold for declaring a leak is experimentally determined from the results of the evaluation of the RD method.

Specificity: Specificity applies to vapor and liquid sensors and lists products or components of products that these sensors can detect. Specificity for quantitative sensors is the ratio of sensor output, or measured concentration, to the actual concentration of hydrocarbon test gas expressed as a percentage. Specificity for qualitative sensors is reported as activated if the sensor responds within 24 hours. Otherwise, specificity is reported as inactivated.

Ullage Test: An ullage test tests the un-wetted portion of the tank, or that portion of the tank that is not in contact with product. These tests can use a variety of physical phenomena including acoustical signals and pressure gain or loss in the ullage space of a sealed system.

Resolution: The resolution of a measurement system is the smallest change in the quantity being measured which the system is capable of detecting.

Precision: The degree of agreement of repeated measurements of the same parameter. Precision estimates reflect random error and are not affected by bias.

Probe: A component of a detection system that must come into contact with product before product can be detected or measured.

Qualitative Responses: The type of detector response that indicates only the presence or absence of product without determining the specific product concentration or thickness.

Quantitative Response: A type of detector response that quantifies the concentration or thickness of product present.

False Alarm: Declaring a tank to be leaking when in fact it is tight.

Probability of False Alarm, P(FA): The probability of declaring a tank to be leaking when it is tight. It is usually expressed as a percentage.

Probability of Detection, P(D): The probability of detecting a leak of a given size and is usually expressed as a percentage.

Activated: Refers to the state of a qualitative detector's response when indicating the presence of product.

Continuous Detector: Detectors that operate continuously and are always present and are never turned off.

Intermittent Detector: Detectors that monitor on a regular basis. An intermittent detector may be a hand held device that is portable or a permanently installed device that is used to periodically test for the presence of product.

Response Time: A general term that refers to the more specific terms of lag time, rise time, and fall time.

Rise Time: The elapsed time from a detector's first detectable signal in response to the presence of product to an output that is 95% of full scale for a quantitative detector or activated for a qualitative detector.

Lag Time: The elapsed time from the detector's first contact with test product to the first detectable signal.

Detection Time: The sum of rise time and lag time.

Fall Time: The elapsed time after a detector has responded to a test hydrocarbon and is removed and has recovered to 95% of its original baseline level or there is no detectable signal output.

Manifolded Tanks: Manifolded tanks are those tanks that are connected by piping that allows the tank system to function as a single tank. A typical manifolded tank system usually consists of two tanks connected by a syphon tube that permits the product in the tanks to be at the same level while product is being pumped out of only one tank.

Nominal Leak Rate: The set or target leak rate to be achieved as closely as possible during the evaluation of a leak detection method. It is a positive number expressed in gallons per hour (gal/h).

Induced Leak Rate: The actual leak rate, in gal/h, used during the evaluation against which the results from a given test device will be compared.

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Measured Leak Rate: A positive number, in gal/h, measured by the test device that indicates the amount of product leaking out of the tank. A negative number would indicate that something was being added to the tank. The performance of a method is based on how well the measured leak rate compares to the actual induced leak rate.

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